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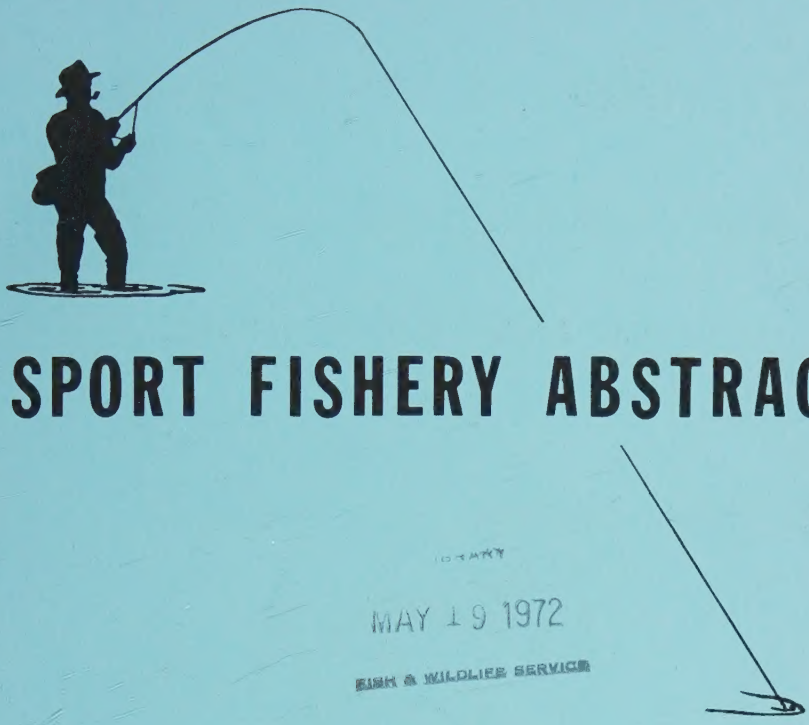

SPORT FISHERY ABSTRACTS

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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13874. Schindler, D. W., A. S. Clark, and J. R. Gray (Dept. of Biology, Trent Univ., Peterborough, Ontario, Canada). 1971. SEASONAL CALORIFIC VALUES OF FRESHWATER ZOOPLANKTON, AS DETERMINED WITH A PHILLIPSON BOMB CALORIMETER MODIFIED FOR SMALL SAMPLES. J. Fish. Res. Bd. Canada, 28(4): 559-564.

A modified temperature sensing circuit for the Phillipson microbomb calorimeter allowed accurate calorific determinations on samples as small as 3 cal. Calorific values of copepods from three lakes in eastern Ontario varied with species, developmental stage, lake, season, and year. No such differences were observed in calorific values for the few species of rotifers and cladocerans tested. Similar calorific values were obtained for samples preserved by freezing, freeze-drying, and heat-drying, but preservation in formalin resulted in erroneously low calorific values. (Authors)

13875. Sutterlin, A. M., and N. Sutterlin (Fish. Res. Bd. Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. ELECTRICAL RESPONSES OF THE OLFACTORY EPITHELIUM OF ATLANTIC SALMON (Salmo salar). J. Fish. Res. Bd. Canada, 28(4): 565-572.

Multiunit spike activity was recorded from the olfactory mucosa of Atlantic salmon (Salmo salar) using metal-filled glass microelectrodes. A number of simple and complex solutions were tested for stimulatory effectiveness. Amino acids as a class of compounds were highly stimulatory; little or no response was obtained to a variety of simple sugars, n-aliphatic acids, alcohols, or amino-substituted alcohols. An increase in asynchronous spike activity was evoked by low concentrations of amino acids and oscillatory activity was evoked by higher concentrations of amino acids. Brief treatment of the epithelium with dilute solutions of $HgCl_2$ blocked the chemosensitivity of the receptors. (Authors)

13876. Acara, A. H., and H. D. Smith (Dept. of Recreation and Conservation, Fish and Wildlife Branch, Victoria, British Columbia, Canada). 1971. A TECHNIQUE FOR ENUMERATING KOKANEE SALMON (Oncorhynchus nerka) FRY MIGRATING THROUGH STREAMS, WITH AN APPENDIX FOR PROCESSING CATCH DATA BY IBM 360 FORTRAN IV COMPUTER PROGRAMS. J. Fish. Res. Bd. Canada, 28(4): 573-585.

A technique for enumerating kokanee salmon (Oncorhynchus nerka) fry migrating downstream was developed in Meadow Creek (a tributary to the Duncan River and Kootenay Lake, B. C.) and was used to obtain an estimate of 10.06 million kokanee fry in 1968. The hyperbolic relation between the nightly mean catch per net per minute (C) and nightly probable error (E) as the percent of the nightly total was expressed by $\log E = -0.5703 - 0.4568 \log C$; E was largest at the beginning and end, and smallest at the peak of fry migration. E was also calculated as the percent of the seasonal total, and in 1968 was $\pm$ 5.8%. Of this total, $\pm$ 0.7% was accumulated during April, when 6.4% of the migration occurred; $\pm$ 3.9% was accumulated in May, when 82.2% of the migration occurred; and the final $\pm$ 1.2% was accumulated in June, when 11.2% of the migration occurred. The variability in abundance of fry and spacing of groups of fry are considered to be the most important factors controlling the magnitude of error. Some aspects of migratory behaviour of kokanee fry in Meadow Creek were revealed and their effects on estimates of abundance are discussed. A series of IBM 360 Fortran IV computer programs for processing catch data are also given in an appendix. (Authors)

13877. Manion, P. J., and H. A. Purvis (U. S. Fish and Wildl. Serv., Sea Lamprey Control, Marquette, Michigan). 1971. GIANT AMERICAN BROOK LAMPREYS, Lampetra lamottei, IN THE UPPER GREAT LAKES. J. Fish. Res. Bd. Canada, 28(4): 616-620.

Five female American brook lampreys, Lampetra lamottei, collected in lakes Michigan and Huron averaged nearly twice as long and about six times as heavy as American brook lampreys of normal size. Three factors suggested that the giant lampreys may have fed parasitically after metamorphosis: morphological adaptations of the species for parasitic life, their large size, and absence of extremely large ammocetes among a million sampled. (Authors)

13878. Dickson, I. W., and R. H. Kramer (Utah Coop. Fish. Unit, Utah State Univ., Logan, Utah). 1971. FACTORS INFLUENCING SCOPE FOR ACTIVITY AND ACTIVE AND STANDARD METABOLISM OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 28(4): 587-596.

Scope for activity was similar for hatchery and wild rainbow trout (Salmo gairdneri), except at 25 C where values for wild trout were significantly higher than those for hatchery trout. In hatchery and wild rainbow trout, respectively, scope for activity was highest at 15 and 20 C. Active metabolism increased with temperature to 570 and 592 mg O_2/kg per hr at 15 and 20 C, respectively. At 25 C, active metabolic rates of wild trout were higher than those for hatchery trout. In hatchery and wild trout, respectively, standard metabolism increased from 36 and 42 mg O_2/kg per hr at 5 C to 138 and 120 mg O_2/kg per hr at 25 C. Scope for activity of hatchery trout was highest after 6 days starvation. Starvation had no effect on active metabolism of hatchery trout, but decreased their standard metabolism after 2 days. Scope for activity and active and standard metabolism of wild trout were similar during forenoon to those during afternoon when light simulated natural day and night and also when lighting was constant for 24 hr. Active metabolism of hatchery trout was higher during the spawning period than other periods of the year and was consistently the higher for males throughout the year. (Authors)

13879. Wedemeyer, Gary, and K. Chatterton (Bur. Sport Fish. & Wildl., Western Fish Disease Lab., Seattle, Washington). 1971. SOME BLOOD CHEMISTRY VALUES FOR THE JUVENILE COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 28(4): 606-608.

Overlapping Gaussian distribution curves were resolved into normal ranges for 1800 clinical test values obtained from caudal arterial blood or plasma of more than 1000 juvenile coho salmon (Oncorhynchus kisutch) held under defined conditions of diet and temperature. Estimated normal blood chemistry ranges were bicarbonate, 9.5-12.6 mEq/liter; blood urea nitrogen (BUN), 0.9-3.4 mg/100 ml; chloride, 122-136 mEq/liter; cholesterol, 88-262 mg/100 ml; pCO_2, 2.6-6.1 mmHg(10 C); glucose, 41-135 mg/100 ml; hematocrit, 32.5-52.5%; hemoglobin, 6.5-9.9 g/100 ml; total protein, 1.4-4.3 g/100 ml; blood pH (10 C), 7.51-7.83. The calculated range of normal acid-base balance vs. water temperature is also presented. (Authors)

13880. Hogan, Roger L., and Eugene W. Roelofs (Dept. of Fish. & Wildl., Mich. State Univ., East Lansing, Michigan). 1971. CONCENTRATIONS OF DIELDRIN IN THE BLOOD AND BRAIN OF THE GREEN SUNFISH, Lepomis cyanellus, AT DEATH. J. Fish. Res. Bd. Canada, 28(4): 610-612.

When green sunfish, Lepomis cyanellus, were exposed to concentrations of dieldrin averaging 6 ppb for periods ranging from 124 to 139 hr, the concentrations of dieldrin in the blood and brain at death were approximately 6.0 and 9.0 µg/g. Surviving fish had concentrations markedly lower than those that died. A correlation coefficient of 0.95 was found between concentrations of dieldrin in the blood and in the brain, water dieldrin concentrations having a slight influence on the concentrations in the blood at death. Surviving fish exhibiting severe poisoning symptoms had higher concentrations of dieldrin in the blood and brain than did those showing moderate to minimal symptoms. (Authors)

13881. Hogan, James W. (Fish-Pesticide Res. Lab., Bur. Sport Fish. & Wildl., U. S. Dept. of the Interior, Columbia, Missouri). 1971. SOME ENZYMATIC PROPERTIES OF PLASMA ESTERASES FROM CHANNEL CATFISH (Ictalurus punctatus). J. Fish. Res. Bd. Canada, 28(4): 613-616.

Rates of ester hydrolysis by plasma enzymes from five fish species ranged from 12.8 to 46.6 µmoles acetylcholine hydrolyzed/ml plasma per hr. Enzymes in channel catfish (Ictalurus punctatus) plasma hydrolyzed the substrates acetylcholine, phenyl acetate, and glyceryl triacetate at rates of 28.1, 96.7, and 6.8 µmoles substrate hydrolyzed/ml plasma per hr, respectively. Esterolytic activity was attributed, in part, to an acetylcholinesterase-like enzyme. In vitro organophosphate inhibition of enzymes in channel catfish plasma was similar to that previously reported for catfish brain acetylcholinesterase (EC 3.1.1.7, acetylcholine acetyl-hydrolase). (Auth.)

13882. Fisheries Research Board of Canada (Ottawa, Canada). 1971. REVIEW 1969-1970. THE FISHERIES RESEARCH BOARD OF CANADA. Review of the Fisheries Research Board of Canada, 1969-1970, 217 p., illus.

Some 1969-1970 activities: Blood proteins of salmon caught off west Greenland showed that about half the salmon present were of North American origin; the other half came from Europe. Salmon tagged during the controversial drift-net fishery off Port aux Basques, Newfoundland, in May and June mostly returned to Canadian mainland rivers. - Encouraging results came from introducing Pacific pink salmon into North Harbour River, Newfoundland, by transplanting eyed eggs from 1959 through 1966. In 1969 a run of 1116 adult fish from natural spawning returned to their home stream, while 106 were known to go to other rivers and the commercial fishery took another 800. - Arctic char tagged in the mouth of the Kuujjua River on the west side of Victoria Island, N. W. T., migrated at least 60 miles. The river population is exploited by summer and winter domestic fisheries, as well as by a summer sport fishery, the local catch being about 70, 000 lb annually. - On the Pacific coast an X-ray spectroscopy system has been developed for use in identifying the area of origin of different salmon stocks. - Experimental utilization of shallow "winterkill" lakes for trout-rearing on the Prairies was extended. Rainbow trout planted in the spring of 1969 as fingerlings were harvested in late autumn at an average weight of 14 oz. The net yield is up to 125 lb per acre as compared to about 3 lb per acre for other commercial fish in that region. The color and flavor of the trout is much better than that of most rainbow trout sold commercially. - In 1969, massive water pollution and fish kills were caused by elemental phosphorus from a plant in Placentia Bay, Newfoundland. Research by FRB concentrated into a period of a few months showed that elemental phosphorus is extremely toxic to fish, that it accumulates in fish tissues, and that an abnormal red coloration of herring was caused by destruction of red blood cells. New analytical techniques had to be developed to detect elemental phosphorus in minute quantities in sea water. - Serious concern, over the discovery in December 1969 of dangerous levels of mercury in fish from the Saskatchewan River, had expanded by summer 1970 into a nation-wide pollution problem. FRB has been heavily involved in a priority program to determine the extent and degree of mercury contamination in many species of fish and marine mammals and sediments. - FRB scientists made major contributions to the International Joint Commission on Pollution of the Lower Great Lakes including an assessment of the present state of eutrophication, recent historical changes, and recommendations on dealing with enrichment by phosphates and other pollutants.

13883. Wyatt, Ellis J., and Kirk T. Beiningen (Oregon Fish Comm., Clackamas, Oregon). 1969. A NITROGEN GAS DISEASE CATASTROPHE. Proc. of the 20th Ann. Northwest Fish Culture Conf., Dec. 3-4, 1969; Washington Dept. of Game, Olympia, Wash., pp. 71-72; Selected Water Resources Abstracts, 4(14): p. 39, 1971.

A severe fish loss is described at the Fish Commission of Oregon's South Santiam Fish Hatchery. Approximately 75-95% of the stock died of gas embolism. Attempts were made to recreate the conditions. Nitrogen gas concentrations were approximated at 175% saturation. Fish died 2 min after first showing signs of abnormal behavior. An LT (100%) (N - 476 fish) occurred at 295 minutes.

13884. Reinert, Robert E. (Bur. of Comm. Fish., Great Lakes Fishery Lab., Ann Arbor, Michigan). 1969. INSECTICIDES AND THE GREAT LAKES. Limnos Magazine, (Great Lakes Foundation), Vol. 2(3): 4-9; Selected Water Resources Abstracts, 4(14): p. 44, 1971.

A brief history of the DDT problem in the Great Lakes is presented. The analysis of coho salmon for insecticides is described, as is the DDT distribution in Lake Michigan coho. Abdominal adipose tissue contained 92. 33 ppm DDT, belly fat 69. 66 ppm, dorsal median fat 62. 82 ppm, lateral line fat 34. 31 ppm, and flesh 5. 66 ppm. The possible implications of the DDT laden fish on human health are discussed.

13885. Skerfving, Staffan, Kerstin Hansson, and Jan Lindsten (National Inst. of Public Health, Stockholm, Sweden). 1970. CHROMOSOME BREAKAGE IN HUMANS EXPOSED TO METHYL MERCURY THROUGH FISH CONSUMPTION. Archives Environmental Health, Vol. 21, pp. 133-139; Selected Water Resources Abstracts, 4(14): p. 41, 1971.

Several alkyl mercury compounds, phenyl mercury, and methoxyethyl mercury have been shown to induce chromosome abnormalities in different organisms. Preliminary study shows an increased frequency of chromosome breaks in cells from lymphocyte cultures from nine subjects known to have increased blood levels of mercury. The subjects had eaten contaminated fish at least three times a week for more than five years. Mercury levels in these fish ranged from 1 to 7 ppm. Three subjects had not consumed contaminated fish for 5 to 18 months; the others were still exposed. Four healthy subjects were studied as controls. Mercury level in red blood cells was measured for all subjects. The exposed subjects had levels about 2 to 40 times higher than unexposed subjects. There was no statistically significant difference in the frequency of chromosome breaks between the control and the exposed group. However, there was a significant correlation between the frequency of cells with breaks and mercury concentration. The biological significance of these findings is not known.

13886. Wallace, Oliver P., Sr., and David P. Olson (New Hampshire Agric. Exp. Sta., Durham, New Hampshire). 1969. RECREATIONAL USE OF THE 13-MILE WOODS SECTION OF THE ANDROSCOGGIN RIVER. New Hampshire Agric. Exp. Sta. Research Report No. 8, 20 p., illus.

The 13 mile Woods section of the Androscoggin River between Errol and Berlin, New Hampshire is a relatively large cold water river with alternating sections of rapids and placid pools. This section of the River flows through a mostly forested land of comparatively little development; thus the region has a remote, wild character. Counter proposals either to dam this section of the River for the production of hydroelectric power or to preserve the forests, wildlife, fishing and recreation along the River revealed that little was known about the recreational use of the area. Therefore, a study of the use and the socio-economic aspects of the River recreation was initiated and carried out over a 90-day period in the summer of 1967. During the study period there were 22,230 man-days of recreation, an average of 247 people per day. Fishing was the most popular recreation activity, 40 percent of the total; sightseeing (25 percent), camping (15 percent), picnicking (10 percent), canoeing (4 percent) and miscellaneous activities (6 percent) made up the remainder. Recommendations for management based upon the reactions of people to this area indicate that the most essential quality of the River is the wild flavor of both the River and its setting. Developments for recreational users should recognize this preference and thus be confined to the westerly bank. The long slow stretches are little used now but offer ideal sites for picnicking and camping. The areas of rapids are used heavily and therefore should have little further development. The fisherman is the number one user and plans should be based upon fishing as the major activity with the unique wild character of the River section being maintained. (From authors summ.)

13887. Fast, Arlo W., and James A. St. Amant (Calif. Dept. of Fish & Game, Sacramento, California). 1971. NIGHTTIME ARTIFICIAL AERATION OF PUDDINGSTONE RESERVOIR, LOS ANGELES COUNTY, CALIFORNIA. Calif. Fish Game, 57(3): 213-216.

Puddingstone Reservoir has a yearlong warmwater fishery, but a trout fishery only during the cooler months. The reservoir was artificially destratified during 1968 using a nighttime air injection schedule in an attempt to lower the water temperature and eliminate an oxygen deficit; thereby creating suitable summer trout habitat. Nighttime air injection maintained suitable oxygen levels, but increased minimum temperatures to intolerable levels. A system of hypolimnion aeration is recommended whereby both adequate oxygen and temperature for trout will be maintained at all times of the year. (Authors)

13888. Acton, Ronald T., Peter F. Weinheimer, Shelby J. Hall, William Niedermeier, Emma Shelton, and J. Claude Bennett (Dept. of Microbiology and Div. of Clinical Immunology and Rheumatology, Dept. of Medicine, Univ. of Ala. in Birmingham, Birmingham, Alabama). 1971. TETRAMERIC IMMUNE MACROGLOBULINS IN THREE ORDERS OF BONY FISHES. Proc. of the National Acad. of Sci., 68(1): 107-111. (Address reprint requests to Dr. Bennett at the Univ. of Alabama).

The immune IgM-like macroglobulins were isolated from three species of bony fishes (Ictalurus punctatus, Lepisosteus osseus, and Polyodon spathula) representing the three orders of the subclass Actinopterygii. These macroglobulins were found to have sedimentation coefficients of 14 S and molecular weights of 600,000-630,000. The carbohydrate compositions were determined and found to be different from that of human macroglobulins. After reduction and alkylation, the heavy and light chains could be separated by gel filtration and were found to have molecular weights of approximately 70,000 and 23,000 respectively. The amino acid compositions of these chains were similar to those of mammalian IgM heavy and light chains. The macroglobulins were found by electron microscopy to have a tetrameric structure, in contrast to the pentameric structure found in mammalian, chicken, and shark IgM, i. e. in species later on the evolutionary scale. (Authors)

13889. Bulow, Frank J. (Iowa Coop. Fish. Unit, Iowa State Univ., Ames, Iowa). 1971. SELECTION OF SUITABLE TISSUES FOR USE IN THE RNA-DNA RATIO TECHNIQUE OF ASSESSING RECENT GROWTH RATE OF A FISH. Iowa State Journ. of Science, 46(1): 71-78.

Feeding experiments with bluegills (Lepomis macrochirus) indicated that growth rate, as indicated by changes in length and weight, was reflected in RNA-DNA ratios of liver, stomach, intestine, anterior muscle, and posterior muscle tissue samples. RNA-DNA ratios in bluegill liver were most sensitive to changes in body weight, followed by muscle tissue, stomach, and intestine, respectively. (Auth.)

13890. Coastal Plains Center for Marine Development Services. 1971. MARINE RESEARCH IN THE COASTAL PLAINS REGION. Coastal Plains Center for Marine Development Services, P. O. Box 3643, Azalea Sta., Wilmington, North Carolina.

This catalog of marine research projects, containing information on marine-related investigations undertaken in the Coastal Plains Region of North Carolina, South Carolina, and Georgia from 1969 to 1971 includes more than 220 projects and carries a complete listing of the names of the investigators conducting the work, organizations administering the projects, and the sponsoring activities. Copies of this and other Center publications on marine and coastal environmental activities of the Coastal Plains Region can be obtained free of charge by writing to the Coastal Plains Center for Marine Development Services, P. O. Box 3643, Azalea Station, Wilmington, North Carolina 28401.

13891. Martens, D. W., R. W. Gordon, and J. A. Servizi. 1971. TOXICITY AND TREATMENT OF DE-INKING WASTES CONTAINING DETERGENTS. International Pacific Salmon Fish. Comm. Progress Report No. 25, 24 p.

Some lethal and sublethal effects on juvenile sockeye (Oncorhynchus nerka) and pink salmon (O. gorbuscha) of proposed de-inking wastes and the detergents contained therein were investigated. The toxicity of de-inking wastes was attributed primarily to its content of nonionic detergents, Nalco 808 and Sterox MJ-b. These detergents caused lethargy, excessive mucous secretion on the gills and depressed oxygen consumption of salmon fry at concentrations less than the lethal level. The biochemical oxygen demand (BOD) of de-inking wastes was easily reduced by biological treatment, as reported elsewhere, but the wastes were generally not readily detoxified owing to resistance of the detergents to detoxification. Detergents were removed from solution by activated carbon but this method of treatment would be costly since pre-treatment to remove excess organic matter and suspended solids would be required. Thus the alternatives for treatment of the proposed wastes appeared to be selection of detergents which would be readily detoxified during biological treatment, or selection of a method such as activated carbon treatment which was capable of removing the detergents. (Authors)

13892. Anderson, Emory D., and Lloyd L. Smith, Jr. (Dept. of Entomology, Fisheries, and Wildlife, Univ. of Minn., St. Paul, Minnesota). 1971. A SYNOPTIC STUDY OF FOOD HABITS OF 30 FISH SPECIES FROM WESTERN LAKE SUPERIOR. Univ. Minn., Agric. Exp. Sta., Tech. Bull. 279, 199 p.

Recent modifications in the fish stocks of Lake Superior and the other Great Lakes have caused great concern and indicated a need for further ecological understanding of the fish species. Food habits studies of Lake Superior fish are limited. This paper describes the food habits of fish collected during 1965-68 in the Apostle Islands and Duluth-Superior regions of western Lake Superior, estimates abundance of the species caught in bottom otter trawl tows, and evaluates the food interrelationships of these species. Food habits data obtained from 5, 871 fish are reported for each species by size class and month as the percentage of occurrence and percentage of total volume for each food item. Crustaceans (Mysis relicta, Pontoporeia affinis, and copepods) constituted the principal segment of the diet of most species during some or all phases of their life history, while certain species also tended to rely heavily on insects, fish, molluscs, and fish eggs. Smelt (Osmerus mordax) was the most abundant species in trawl catches followed by slimy sculpins (Cottus cognatus), ninespine sticklebacks (Pungitius pungitius), trout-perch (Percopsis omiscomaycus), and bloaters (Coregonus hoyi). Abundance estimates and food habits of each species were employed to calculate a percentage use value that roughly described the proportion of a given food item used by that species. Results showed a predominant percentage use by smelt of crustaceans, Mysis, copepods, and molluscs. Slimy sculpins were the primary user of amphipods and fish eggs. Percentage use of insects and fish was greatest by trout-perch and lake trout (Salvelinus namaycush), respectively. (Authors)

13893. U. S. Bureau of Sport Fisheries and Wildlife. 1971. AN EVALUATION OF COORDINATION BETWEEN STATE HIGHWAY AND STATE FISH AND GAME DEPARTMENTS. U. S. Dept. of the Interior, Bur. Sport Fish. and Wildl., 11 p., illus.

The Bureau of Sport Fisheries and Wildlife's role in highway coordination should be made absolutely clear to all States. The understanding of highway coordination procedure by States has declined since 1965. This indicates that the Bureau needs to step up contacts with States to review the past and consider future highway procedures. Lack of understanding probably develops when personnel changes are made. Highway coordination, however, is a continuing process and the Bureau should maintain continuity. The Bureau's role, after having assisted in achieving the issuance of IM 21-5-63, is largely one of an advisor to fish and wildlife interests in the States. In situations where State highway and fish and game agencies cannot agree, the Bureau will assist on behalf of fish and wildlife interests, if requested by the State agency. Of course, the Bureau becomes directly involved if lands or vested interests under its jurisdiction are affected by highway construction projects. The general trends in this summary indicate improvement in highway coordination. There is still a long way to go, but progress is being made. The present favorable public reaction to environmental issues is encouraging and undoubtedly will support efforts in modification of highway plans to benefit fish and wildlife. (Conclusion and recommendation)

13894. Caribbean Research Institute. 1969. SPECIAL REPORT. STUDY OF THE FISHERIES POTENTIAL OF THE VIRGIN ISLANDS. Virgin Islands Ecological Res. Sta. Contribution No. 1, 197 p.

As a result of the observations made during this project we conclude that there are many problems associated with an effort to upgrade and enlarge a commercial fishery which would be limited to Virgin Islands waters. The first major difficulty, as it is everywhere in the United States, is in convincing young men that there is a future in fishing and that it is possible to make an adequate and respectable livelihood from commercial fishing. The second major problem is the relatively high cost of procuring, maintaining and operating power boats in the Virgin Islands. The third major problem is one related to the lack of modern, sanitary, suitable marketing procedures and lack of education regarding the edibility and desirability of certain species which could enter the market. Another problem is one which at

the present time makes all others academic. The presence of ciguatera and its effects on the retail and wholesale market value of local inshore fish are difficult to analyze. Many people have been poisoned and most people are afraid of being poisoned. It seems almost certain that if this problem can be resolved the sale of local fresh fish will increase dramatically. The nature of the Virgin Islands shelf area poses severe restrictions on the numbers and kinds of fish which are present, and on the methods which can be used to harvest them. (From conclusions and recommendations)

13895. Caribbean Research Institute. 1970. SPECIAL REPORT. EXPLORATORY FISHING FOR A SOURCE OF NON-CIGUATOXIC SPORT AND FOOD FISH. Virgin Islands Ecological Res. Sta. Contribution No. 2, 48 p.

Exploratory fishing for snappers and groupers was effected in the waters at the edge of the Virgin Islands plateau. Several species appear to exist in relative abundance at depths of 50 to 130 fathoms along the outer slope of the plateau. The fish caught from these areas to date have proven to be non-ciguatoxic. Bioassay methods employed to date have not proved successful in determining whether a fish is ciguatoxic.

13896. McKechnie, Robert J., and Richard B. Fenner. 1971. FOOD HABITS OF WHITE STURGEON, Acipenser transmontanus, IN SAN PABLO AND SUISUN BAYS, CALIFORNIA. Calif. Fish Game 57(3): 209-212.

The diet of white sturgeon is described based on an examination of the contents of 355 stomachs. Benthic invertebrates dominated the diet, with several species of clams being the most consistent important item. Barnacles, crabs and shrimp were important at times, but annelids were seldom eaten even though they are numerous in the area. Seasonally herring eggs were a major food, and several species of small fishes were sometimes eaten. (Authors)

13897. Carlisle, John G., Jr. 1971. FOOD OF THE JACK MACKEREL, Trachurus symmetricus. Calif. Fish Game 57(3): 205-208.

A food study of jack mackerel Trachurus symmetricus was carried out on samples taken during part of 1950, most of 1951 and part of 1952. Simultaneous plankton tows were taken at the time of sampling. Jack mackerel were selective feeders. Over 90% of the food in the stomach samples consisted of copepods, pteropods and euphausiids. Little correlation was noted between plankton samples and stomach contents. Only limited competition appears to exist between jack mackerel and sardines. (Auth.)

13898. Blunt, C. E., Jr., and Makoto Kimura. 1971. AGE COMPOSITION OF SARDINE LANDINGS ON THE PACIFIC COAST OF THE UNITED STATES AND MEXICO IN 1965-1966. Calif. Fish Game 57(3): 202-204.

California landings of the Pacific sardine, Sardinops caeruleus (Girard), during the 1965-66 canning season amounted to only 365 tons -- the poorest catch in the history of the fishery. Baja California landings totaled 7, 235 tons. Most of the sardines processed at Ensenada came from San Sebastian Vizcaino Bay area. The age structure of southern California landings reflected failure of the sardine population in the north to produce good year-classes. Ninety-six percent of the fish landed were age group IV and older. (Authors)

13899. Parrish, Richard H., and Eric H. Knaggs. 1971. REVISION OF THE AGE COMPOSITION OF THE SOUTHERN CALIFORNIA CATCH OF PACIFIC MACKEREL FOR THE 1958-59 THROUGH 1963-64 SEASONS. Calif. Fish Game 57(3): 182-201.

Errors in age assignments of the Pacific mackerel, Scomber japonicus (Houttuyn), catch off southern California for the 1958-59 through 1963-64 seasons were found. When these were corrected, many previously aged fish were assigned to older age groups which resulted in the apparent increase in growth rate being reduced to a level comparable with the 1939 through 1957 period. Of particular importance was a 58% decrease in total estimated number of age-group 0 fish and a subsequent 30% increase in age-group I fish. (Authors)

13900. Smith, Albert C. 1971. PROTEIN DIFFERENCES IN THE EYE LENS CORTEX AND NUCLEUS OF INDIVIDUAL CHANNEL ROCKFISH, Sebastolobus alascanus. Calif. Fish Game 57(3): 177-181.

Albumins and globulins were extracted from the aqueous humor, lens cortex, and various layers of the lens nucleus of individual channel rockfish, Sebastolobus alascanus. Protein from the nucleus was the most resistant to denaturation and produced the simplest electrophoretic pattern. These findings suggest that electrophoretic patterns of nuclear lens proteins would be useful in a study of the rockfish family, which is taxonomically complex. (Auth.)

13901. Waggoner, John P. III, and C. Robert Feldmeth. 1971. SEQUENTIAL MORTALITY OF THE FISH FAUNA IMPOUNDED IN CONSTRUCTION OF A MARINA AT DANA POINT, CALIFORNIA. Calif. Fish Game 57(3): 167-176.

Environmental parameters such as dissolved oxygen, water temperature, and salinity were monitored in a drawn-down impoundment at Dana Point, California, during July and August, 1969. Sequential mortality of marine fishes occurred in this impoundment. The first major peak of mortality corresponded to a 2 to 5 ppm decrease in oxygen and a temperature increase of 8 to 9 C. The other two peaks corresponded to temperature peaks 10 to 12 C above ocean temperatures. Surfperch (Embiotocidae) seemed to be least tolerant of environmental stresses encountered, while elasmobranchs and flatfishes were the most tolerant. (Authors)

13902. Hazel, Charles R., Walter Thomsen, and Stephen J. Meith. 1971. SENSITIVITY OF STRIPED BASS AND STICKLEBACK TO AMMONIA IN RELATION TO TEMPERATURE AND SALINITY. Calif. Fish Game 57(3): 138-153.

Toxicity of undissociated NH_4OH to striped bass (Morone saxatilis) and stickleback (Gasterosteus aculeatus) was determined by static bioassay at 15 C and 23 C in freshwater, 33% seawater, and seawater. The 96-hr median tolerance limits (TLm) of striped bass in mg/liter NH_4OH were as follows: at 15 C--freshwater 2.8, brackish water 2.8, and seawater 2.0; at 23 C--freshwater 1.9, brackish water 2.1, and seawater 1.5. The 96-hr TLm of sticklebacks were: at 15C -- freshwater 2.1, brackish water 5.2, and seawater 10.4; at 23C-- freshwater 1.8, brackish water 2.4, and seawater 2.3. The influence of salinity and temperature on the toxicity of undissociated ammonia was less for striped bass than for sticklebacks; or sticklebacks were more resistant to ammonia poisoning at the higher salinities and the lower temperature. Striped bass were slightly more tolerant in brackish water than in freshwater or seawater. (Authors)

13903. Tatum, William R. (Tennessee Game and Fish Commission). 1968. FIELD OBSERVATIONS ON THE USE OF SODIUM CYANIDE IN STREAM SURVEYS. Presented at 22nd Ann. Meeting of the Southern Div. of Amer. Fish. Soc., Baltimore, Oct. 21-23, 1968, unpublished; Selected Water Resources Abstracts, 4(13): p. 38, 1971.

Sodium cyanide has been an effective method for sampling the stream fish populations in Eastern Tennessee. Its portability makes it a practical stream management tool. Cyanide is an excellent cold weather sampling method. Three ounces of cyanide in trout streams and six ounces in warmwater streams per cubic foot per second flow will sample 100 yards. In water colder than 55F, mortality of fish is not acute. Rainbow trout and various warmwater fish collected with cyanide and held in aquaria showed no deleterious effects from exposure to the chemical. Reduction in stream invertebrate populations after cyanide application is evident.

13904. Cairns, John, Jr., and Kenneth L. Dickson (Virginia Polytechnic Institute, Blacksburg, Virginia). 1971. A SIMPLE METHOD FOR THE BIOLOGICAL ASSESSMENT OF THE EFFECTS OF WASTE DISCHARGES ON AQUATIC BOTTOM-DWELLING ORGANISMS. J. Wat. Poll. Contr. Fed., 43(5): 755-772, illus

13905. Asano, Shoji, Sumio Nagasawa, and Shizue Fushimi (Ihara Agric. Chemicals Inst., Shimizu, Japan). 1969. THE RELATION BETWEEN TEMPERATURE AND TOXICITY OF PCP FOR THE CARP FISH. STUDIES ON THE BIOLOGICAL ASSAY OF CHEMICALS TO FISH. VI. Botyu-Kagaku, 34(1): 13-21, in Japanese with English summary; Selected Water Resources Abstracts, 4(13): p. 39, 1971.

Relationships between the lethal action of PCP-Na (sodium pentachlorophenate) salt to carp and temperature are discussed from statistical and physiological points of view. A complete time-mortality curve is presented. The median lethal times in a PCP concentration of 0.8 ppm were determined at 23, 26, 29, 32 and 35 deg C. A linear relationship between the median lethal time and temperature was obtained, and a positive temperature coefficient for PCP lethality was found. PCP's lethality increases approximately two-fold with each 10 deg C rise in temperature. The standard deviation of the carp's susceptibility, however, increases with increasing temperature. The median lethal times at PCP concentrations of 0.5 to 16.0 ppm were also determined at 20, 23, 26, 29 and 32 deg C. The relationship between lethal time, PCP concentration and temperature could be determined with a multiple regression equation. By transforming concentration into temperature, with a factor for equalizing individual differences in lethal concentration, the relationship between temperature and lethal time was derived. A linearity similar to that described above was obtained between these two variables.

13906. Svobodova, Z. (Vyzkumny Ustav Rybarsky a Hydrobiologicky Vodnany, Prague, Czechoslovakia). 1970. THE LEVEL OF N-AMMONIA AND N-UREA IN THE BLOOD SERUM AND BRAIN OF HEALTHY AND AMMONIA-INTOXICATED CARPS (Cyprinus carpio L.). Bull. VUR Vodnany, 6(1): 11-19, in Czech with English summary; Selected Water Resources Abstracts, 4(13): p. 39, 1971.

The physiological values were determined of N-ammonia and N-urea in the blood serum of carp in two periods (Sept. - Oct. and Nov. - Dec.). Higher values were obtained in September and October, and may be explained by a more rapid metabolism of nitrogenous substances, connected with a higher water temperature. An acute intoxication of carp results in an increase in blood serum N-ammonia levels (five times); a chronic intoxication causes an approximate five-fold increase as compared with physiological values in each case. The methods of ammonia detoxification of carp is discussed. The level of N-ammonia in the brain of the fish after an experimental acute intoxication with ammonia is more than three times that of healthy fish. The use of these results for diagnostic purposes will be subject to further study. Changes in the levels of N-ammonia in the blood serum and brain of carp during acute intoxication with ammonia were examined. The most pronounced rise of the level of N-ammonia occurs during the first five minutes. The level increases only slowly thereafter.

13907. Chen, Carl W., and Robert E. Selleck (California Univ., Dept. of Civil Engineering, Berkeley, California). 1969. A KINETIC MODEL OF FISH TOXICITY THRESHOLD. J. Wat. Poll. Contr. Fed., Aug. 1969, part 2, pp. 294-308; Selected Water Resources Abstracts, 4(13): p. 39, 1971.

A procedure is presented which may be used to determine the threshold concentrations of various mixtures of toxicants as well as to evaluate the proportional amounts of toxicity furnished by the individual toxic components, taking into account possible synergistic or antagonistic effects. For experimental verification of the model, zinc and cyanide were selected as toxicants. The survival function describing the fish bioassay data was found to be exponential after an initial induction period. The exponential rate coefficient is a function of at least four other coefficients when the toxicant concentration is maintained constant. The threshold concentrations of zinc and cyanide under the specified experimental conditions are 0.33 and 0.236 mg/l, respectively.

13908. FAO of the United Nations (Rome, Italy). 1971. REPORT OF THE FAO TECHNICAL CONFERENCE ON MARINE POLLUTION AND ITS EFFECTS ON LIVING RESOURCES AND FISHING. FAO Fisheries Reports, No. 99, 188 p.

13909. Sjolseth, D. E., E. O. Salo, and M. Katz (Washington Univ., Seattle, Washington). 1970. EFFECT OF WATER QUALITY IN BELLINGHAM BAY ON JUVENILE SALMON. Preprint, Fifth Internation.Wat. Poll. Res. Conf., San Francisco, Paper I-26, 27 p.; Selected Water Resources Abstracts, 4(13): p. 40, 1971.

A two-phase investigation into some ecological factors in the estuarine and freshwater nursery areas that may affect salmon and may influence the behavior of juvenile salmon was conducted on the Bellingham Bay - Nooksack River system in Washington State. No significant correlation was found between dissolved oxygen and spent sulfite liquor. No D.O. levels below 6.6 mg/l and no S.S.L.'s above 483 ppm were found. S.S.L. and D.O. were found to have no significant correlation with the catch of salmon. Two salmon streams were studied during the summer to determine coho salmon mortality. In both streams there was over 50% mortality during a six-week period in late summer. It is the freshwater and not the estuarine habitat which is limiting salmon production.

13910. Armstrong, James G., and James D. Williams (Bur. Sport Fish. & Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri). 1971. CAVE AND SPRING FISHES OF THE SOUTHERN BEND OF THE TENNESSEE RIVER. J. Tenn. Acad. Sci., 46(3): 107-115.

Forty-seven species, representing 12 families and 30 genera, were collected from 68 springs, many of which had been developed for various purposes. Development usually destroys the constant spring environment, endangering organisms restricted to the spring habitat. Three species (Typhilichthys subterraneous; Chologaster agassizi; and Etheostoma tuscumbia) collected during this survey are apparently restricted to caves and springs in the survey area. Three additional species known only from caves and springs in the survey area were not collected during this study. The 6 species most frequently collected were Campostoma anomalum, Notropis c. chrysocephalus, Semotilus atromaculatus, Lepomis cyanellus, Rhinichthys atratulus, and Cottus carolinae. The number of species collected at a given locality ranged from 1 to 11 with an average of 5 species per station. (Authors)

13911. Manea, Gheorghe. 1970. PRODUCTION AND STOCKS OF STURGEON THROUGHOUT THE WORLD. (Productia si Rezervele de Sturioni de pe Glob). Buletinul de Cercetări Piscicole 29(4): 52-65 (Institutul de Cercetări si Proiectări Piscicole, Ministerul Industriel Alimentare, B-dul Ana Ipătescu Nr. 46, Bucureşti 22, Republica Socialistă România) (In Rumanian; English, French, and Russian summaries); Comm. Fish. Abstr., 24(9): p. 9, 1971.

The author tabulates the catch of sturgeon, by political and hydrographic area (including those of the United States) over the past several decades. He notes that intense and irrational catches, hydrological and hydrobiological conditions created in dammed rivers, and destruction of fry by use of trap and gill nets have diminished the stocks two- or threefold over the last century in the Azov Sea, the Black Sea, the Siberian river basins, and the Mississippi River basin, to name a few. Therefore, he suggests, the following measures should be taken to restore and preserve the stocks: (1) protect and improve natural breeding zones and protect the fry; (2) interdict, limit and rationally organize catching, the particulars to be governed by the basin, the zone, and the season; (3) annually stock, by plan, rivers that have been dammed for hydroelectric purposes with fry reared in special ponds.

13912. Ricker, W. E. 1971. COMPARISON OF TWO RECRUITMENT CURVES (Sopostavlenie dvukh Krivykh Vosproizvodstva). Rybnoe Khozyaistvo, No. 4, pp. 10-13. In Russian.

A continuation of a mathematical comparison of recruitment curves of Ricker and Beverton-Holt. -- Robert M. Howland

13913. Agrba, M. A. (VNIRO). 1971. A FOOD MIXTURE WITH A PASTE OF CRUSTACEANS (Kormovaya Smes' s Pastoĭ iz Rakoobraznykh). Rybnoe Khozyaistvo, No. 4, pp. 28-29. In Russian.

Experiments showed that with the introduction of krill (25-35%) into the usual

rations the efficiency of utilization of these rations increases 1.5 times; the intensity of growth and fat accumulation was considerably higher in the test Black Sea salmon than in the control, and mortality was 1.5 times lower; the young reared on rations with a krill supplement reached the condition of descent more rapidly. -- Robert M. Howland

13914. Vrochinskiĭ, K. K. (VNIIGINTOKS). 1971. POSSIBLE CONSEQUENCES OF THE ENTRY OF PCC INTO FISHERY WATERS (Vozmozhnye posledstviya popadiniya PKhK v Rybokhozyaĭstvennye Vodoemy). Rybnoe Khozyaistvo, No. 4, pp. 32-33. In Russian.

Polychlorcamphene (PCC) at low concentrations (0.004 mg/l) worsens the organoleptic properties of the water, and after a single application in the course of a 113-day experiment is retained in the hydrobionts. Entry of the pesticide into a body of water even at a concentration of 0.002 mg/l leads to its accumulation in fish organs and tissues. Therefore, PCC must not occur in waters for domestic and fishery use (MPC = 0). -- Robert M. Howland

13915. Kasymov, A. G., and A. R. Khalilov (Inst. of Zool., AS Azerbaijan SSR). 1971. ON THE RESULTS OF THE INTRODUCTION OF MYSIDS INTO MINGECHAUR RESERVOIR (O Rezul'tatakh Introduktsii Mizid v Mingechaurskom Vodokhranilishche). Rybnoe Khozyaistvo, No. 4, pp. 33-34. In Russian.

As a result of the introduction of mysids into Mingechaur Reservoir the ratio of the components of the benthos (by biomass in %) changed considerably. Presently, mysids play an important role in the diet of the fish of Mingechaur Reservoir. Thus, for example, mysids are the principal food of the pikeperch. Mysids comprise 75-76% in the food composition of young pikeperch at a length of 5-12 cm. -- Robert M. Howland

13916. Shvydkaya, N. A., and E. A. Nasedkina (TINRO). 1971. ON THE BIOCHEMICAL VALUE OF VITAMIN PROTEIN FOOD PASTE (O Biokhimicheskoĭ Tsennosti Vitaminnoĭ Belkovoĭ Kormovoĭ Pasty). Rybnoe Khozyaistvo, No. 4, pp. 70-71. In Russian.

Vitamin protein paste, obtained by the concentration of hydrolysates in the production of vitamin A, is a new feed product. The moisture content in the paste averages 59.0%, protein - 25.8%, fat - 4.7%. The mineral residue averages 10.5%, including sodium chloride at 9.0%. It contains the entire complex of the water-soluble B vitamins. Leucine comprises 50% of the total amount of essential amino acids. Glutamic acid makes up about 30% of the total of non-essential amino acids. Vitamin protein food paste is of high biological value. -- Robert M. Howland

13917. Prosyanyĭ, V. S., L. N. Shvets, Yu. A. Zheltov, E. I. Medvedeva, S. V. Krasil'nikova, and E. B. Petrenko (UkrNIIRKh). 1971. ON THE ADDITION OF A PREPARATION OF AMÍNO ACIDS AND PEPTIDES TO A FOOD MIXTURE (O Dobavlenii Preparata Aminokislot i Peptidov v Kormovuyu Smes'). Rybnoe Khozyaistvo, No. 5, pp. 16-18. In Russian.

Experiments demonstrated the promise and expediency of utilizing a preparation of amino acids and peptides, obtained from marine algae, as a supplement to fish (carp) food. Commercial production of this preparation will permit increase in the efficiency of pond culture. -- Robert M. Howland

13918. Liao, I-chiu, Yeoung-jaung Lu, Ting-lang Huang, and Mou-chun Lin (Tungkang Marine Lab., Taiwan Fish. Res. Inst., Tungkang, Taiwan, Republic of China). 1971. EXPERIMENTS ON INDUCED BREEDING OF THE GREY MULLET, Mugil cephalus Linnaeus. Chinese-American Joint Comm. on Rural Reconstruction, Fisheries Series No. 11, pp. 1-29, illus.

This paper is the sixth report of the Working Team on Artificial Propagation of Mullet. The team consisted of the research personnel of several fisheries institutions in Taiwan and was first organized in 1963. The site for work in the 1969-1970 season was Tungkang Marine Laboratory (also known as Tungkang Shrimp

Culture Center) in south Taiwan. The grey mullet, Mugil cephalus Linnaeus, is one of the important commercial fishes in Taiwan, and is especially valued for its roe. For stocking in fresh and brackish water ponds, the fingerlings are normally caught from estuarine waters along the west coast of the island from December to March. Recently, the catch of fingerlings from natural waters has been poor and a shortage of supply resulted. In order to produce fingerlings by artificial propagation, the team has carried out experiments for six years during the mullet spawning season. Significant success was achieved in the experiment from November 1969 to February 1970. A total of 431 hatched larvae were obtained, measuring 3.28 cm and weighing 0.34 g on the 45th day. They were about 1.5 times larger than the fingerlings normally collected from natural waters and were robust and strong. Some of them were stocked in fish ponds and grew to 28.1 cm and 217.4 g by the 200th day. (Authors)

13919. Liao, I-chiu, Dong-liang Lee, Mee-yoon Lim, and Ming-chuan Lo (Tungkang Marine Lab., Taiwan Fish. Res. Inst. Tungkang, Taiwan, Republic of China). 1971. PRELIMINARY REPORT ON INDUCED BREEDING OF POND-REARED MULLET, Mugil cephalus Linnaeus, Chinese-American Joint Comm. on Rural Reconstruction, Fisheries Series No. 11, pp. 30-35. In Chinese with abstract and tables in English.

Artificial propagation of the grey mullet (Mugil cephalus Linnaeus) was successfully accomplished after seven years of experimental work conducted in the winter. In the course of these experiments, mature spawners were obtained from fishing boats at sea, which usually suffered injury while being captured. Weather conditions increased the difficulties of obtaining mature spawners. In order to overcome these difficulties and to establish a more reliable source of mature spawners, work on induced breeding of pond-reared mullet was started. A three-year old spawner measuring 41.5 cm in standard length and 1.2 kg in weight (post-ovulation measurement) from a freshwater pond was used in this experiment. Before hormone treatment, the spawner was reared in a freshwater concrete pond, with sea water gradually added, and the fish was fed with artificial feedstuff. Hormone treatment was the same as for those spawners obtained from the sea. After three injections, the eggs were discharged and fertilized with milt stripped from mature sea mullet. The fertilized eggs hatched well. The rearing of larvae was carried out in 1.0 and 0.5 ton round plastic tanks. Larvae from pond-reared spawner were found to be easier to rear than those of spawners obtained from the sea. By February 22, 717 larvae had survived for 35 days with a standard length of 2.32 cm. The survival rate was 1.48%. Although the result obtained was only that of one spawner, it had proved that pond-reared mullet could be used as spawner in artificial propagation and that the difficulty of obtaining mature spawners could be overcome to a large extent. (Authors)

13920. Chen, Hon-cheng (Rockefeller Foundation Fish Culture Res. Project, Taiwan, Republic of China). 1971. INCREASE OF BENTHIC ALGAE IN MILKFISH PONDS BY APPLICATION OF SILICATE. Chinese-American Joint Comm. on Rural Reconstruction, Fisheries Series No. 11, pp. 71-83.

Conditions provided in the winter preparation of the milkfish ponds are favorable for bottom algal growth, especially the diatoms which might reach 90% of the total bottom algal population. Such continuous growth would eventually deplete the nutrients of the pond, and in Taiwan the problem of silicate deficiency is critical. An experiment was designed and carried out, therefore, to test if this deficiency could be made up with silicate application. Two ponds were treated with sodium silicate and two others used as control. The result was that the ponds with added $Na_2 SiO_3$ yielded chlorophyll 1.72 to 2 times as much as that of the control. In milkfish ponds the limiting level of SiO_3-Si for algal production is 0.25 ppm, but during the winter preparation of ponds SiO_3-Si might be depleted to somewhere between 0 and 0.4 ppm. Inference from experimental data shows that by an application of 100 kg/ha of $Na_2 SiO_3$, the SiO_3-Si concentration could be raised to above 0.25 ppm, but besides this essential element, organic matter is also needed to bring down the pH value and to supply other elements for algal growth. (Auth.)

13921. Ong, Hong-siong (Rockefeller Foundation Fish Culture Research, Chupei Fish Culture Sta., Republic of China). 1971. FERTILIZER EXPERIMENTS IN FRESHWATER FISH PONDS - RELATION OF PHOSPHORUS AND NITROGEN TO PLANKTON AND FISH PRODUCTION. Chinese-American Joint Comm. on Rural Reconstruction, Fisheries Series No. 11, pp. 60-70. In Chinese with English abstract.

The purpose of this experiment was to find the effect of phosphorus and nitrogen fertilizers on the seasonal succession of plankton and fish production in ponds. Two series, A and B, each consisting of five ponds (four treated and one as control), were used. It was found that the monthly fluctuation of phytoplankton production was different from that of zooplankton, as zooplankton became abundant from February to May and phytoplankton were dominant in the months of July to November. In ponds of series A, fish production and phytoplankton abundance were in linear relationship, but in series B, their relationship was irregular. There was no clear relationship between the abundance of zooplankton and fish yield in either series of the experimental ponds. Because of the fact that water supply to the experimental ponds was mixed with the drainage from some rice fields and thus contaminated with both inorganic and organic fertilizers, there was no clear-cut effect of different dosages of fertilizers applied on fish production. Among the ponds of series A, the one that maintained a PO_4-P level of 0.1-0.29 had the highest yield of fish. The addition of nitrogen fertilizer to ponds of series B resulted in a tremendous increase in bluegreen algae but failed to increase fish production, probably due to the low value of bluegreen algae as forage for Chinese carps and further because the bluegreen algae in abundance suppressed the growth of the diatoms and green algae. In fish ponds, adequate growth of phytoplankton in general improves water quality and provides better conditions for fish growth, and it is possible that Chinese carps thrived better in ponds of series A with deeper water than those of series B. (Auth.)

13922. Wu, Wilson Sheng-yu (Rockefeller Foundation Fish Culture Research Project, Taiwan, Republic of China). 1971. A DISEASE OF THE GRASS CARP (Ctenopharyngodon idellus) AND ITS CHEMOTHERAPEUTICAL CONTROL. Chinese-American Joint Comm. on Rural Reconstruction, Fisheries Series No. 11, pp. 87-95.

This investigation has revealed that Aeromonas punctata is associated with the disease of grass carp and that chloramphenicol is effective in inhibiting the growth of this pathogen, but since this is an expensive antibiotic, there is need to find a more economical method of control. (From auth. discussion)

13923. Chiang, Wan (Rockefeller Foundation Fish Culture Research Project, Taiwan, Republic of China). 1971. STUDIES ON FEEDING AND PROTEIN DIGESTIBILITY OF SILVER CARP, Hypophthalmichthys molitrix, (C. & V.). Chinese-American Joint Comm. on Rural Reconstruction, Fisheries Series No. 11, pp. 96-114.

The fish ponds of the Chupei Station are eutrophic and rich in various nutrient elements and algae. Silver carp digests Cyanophyceae easily but Bacillariphyceae with difficulty. Silver carp is a diurnal fish and feeds at 4:00 a.m.-5:00 a.m. It takes ten hours on an average to change ingesta into excreta. pH in the digestive tract of the silver carp ranges from 6.8 to 8.3. There is a positive correlation between digestive tract length (Y) and body length (X). The regression line: $Y = 9.449 X - 102.098$, $r = 0.959$. The indigestible chlorophyll instead of Cr_2O_3 is used as an indicator for the determination of protein digestibility. Protein digestibility of silver carp ranges from 73.33% to 92.70%. Protein is digested mostly in the fore-gut, secondarily in the mid-gut, and little in the hind-gut. There is no difference in digestibility between sexes. Protein digestibility varies with the size of fish: Maximal 200-400 gm, intermediate 20-45 gm, and minimal 500-900 gm. (Auth. summ.)

13924. Henry, Kenneth A. (NMFS Biol. Lab., Seattle, Washington). 1971. ATLANTIC MENHADEN (Brevoortia tyrannus) RESOURCE AND FISHERY - ANALYSIS OF DECLINE. U. S. Dept. of Commerce, NOAA Technical Report NMFS SSRF-642, 32 p.

After record catches in 1961 and 1962 of about 2.3 billion pounds (1.043 million metric tons) of menhaden (Brevoortia spp.), the U. S. catch declined to about 1.2 billion pounds (0.544 million metric tons) in 1967. Most of the decrease was in the North Atlantic and Middle Atlantic. Since about 1940, catches had increased, in general, with increased fishing effort. In recent years, however, the catch per unit of effort (a standard vessel day) has declined markedly. It fell from about 148,000 pounds (67.1 metric tons) in 1962 to about 38,000 pounds (17.2 metric tons) in 1967 in the North Atlantic and from 140,000 pounds (63.5 metric tons) in 1962 to 51,000 pounds (23.1 metric tons) in 1967 in the Middle Atlantic. The catch per unit of effort in these two areas improved in 1968, but fishing effort was at such a low level that the increase is of doubtful significance. Other possible units of effort such as catch per vessel week and catch per landing day are examined. In 1964, the catch in Chesapeake Bay exceeded the catch in the Middle Atlantic for the first time; in 1968, the Chesapeake Bay catch amounted to 63% of the total summer catch of Atlantic menhaden (B. tyrannus). In recent years, over 90% of the fish in the total catch were immature. A relation is established between the estimated abundance of juvenile Atlantic menhaden, based on trawling, and the total catch from the year class. A stock-recruitment relation, based on catch per unit of effort in the Middle Atlantic and total catch from the year class, indicates that the spawning stock is below optimum size. (Auth.)

13925. Ebel, Wesley J. (NMFS Biol Lab., Seattle, Washington). 1971. DISSOLVED NITROGEN CONCENTRATIONS IN THE COLUMBIA AND SNAKE RIVERS IN 1970 AND THEIR EFFECT ON CHINOOK SALMON AND STEELHEAD TROUT. U. S. Dept. of Commerce, NOAA Technical Report NMFS SSRF-646, 7 p.

Concentrations of dissolved nitrogen gas varied widely in 1970 but were generally lower in the Columbia River than in 1968-69. Concentrations were high, however, in some areas of the Snake River in the spring and early summer, mainly because of spilling of water at Little Goose Dam. Symptoms of gas bubble disease were widespread in Snake River juvenile and adult chinook salmon (Oncorhynchus tshawytscha) and steelhead trout (Salmo gairdneri). There were substantial losses of fish, particularly juveniles, during periods of high concentration of dissolved nitrogen gas. (Auth.)

13926. Mathews, Stephen B. (State of Wash., Dept. of Fisheries, Management and Res. Div., Washington). 1971. ECONOMIC EVALUATION OF FORECASTS OF SOCKEYE SALMON (Oncorhynchus nerka) RUNS TO BRISTOL BAY, ALASKA. FAO Fish. Tech. Pap. No. 103, 17 p.

Several fisheries agencies operating in Alaska spend an aggregate of $100,000-$250,000 yearly to forecast the sockeye salmon (Oncorhynchus nerka, Walbaum) runs to Bristol Bay. Accurate forecasts of this widely varying run allow the salmon canning industry to plan efficient yearly scales of operation. Also, accurate forecasts, particularly of the runs to the separate rivers of Bristol Bay, should increase the productivity of the runs by enabling management for optimum escapement. To measure the potential economic value to the canning industry of accurate forecasts, a computer model of the fishery and the canning industry was written and used to simulate performance over 100-year periods. It was concluded that the benefits to the canning industry from forecasting would likely be dissipated in higher raw fish costs if profits were reasonable without accurate forecasts. Higher fish prices with free entry of fishing gear would attract more but superfluous gear which would negate any net economic gain from forecasting. In order for forecasts to provide their greatest yield to the fishery where net yield is the total profit to the canning industry and the fishing fleet, the fleet would need to be greatly reduced. In the simulation model, a fleet of 350 boats was optimal. With this small-sized fleet, an accurate forecast of the total run added $1,200,000 to net yield, and accurate river-system forecasts about $5,000,000. (From auth.)

13927. FAO of the United Nations, Department of Fisheries (Rome, Italy). 1971. DIRECTORY OF FISH CULTURE RESEARCH INSTITUTIONS. FAO Fish. Tech. Pap. No. 85, Revision 1, 119 p.

The first edition of the Directory of Fish Culture Research Institutions (FAO Fisheries Technical Paper No. 85) developed from a Draft List of Fish Culture Research Institutions (FAO Fisheries Circular No. 24) was issued in 1969. The revision and reprinting of the Directory was undertaken earlier than originally planned, to meet the unexpected demand for this document. It was therefore decided to issue this revised edition. Questionnaires were sent to all the listed institutions, as well as some additional ones that came to our notice. The present version was prepared on the basis of information thus obtained. As in the previous edition, only institutions that have continuing programmes of research related to the culture of fish and other aquatic organisms are included. They are solely or partly engaged in fish culture investigations. The problems of current and future research summarized in the Directory do not in every case represent the full work programmes of the institutions, as investigations not directly connected with aquaculture have been omitted. Similarly, the equipment and facilities described are only those mainly used for fish culture work. As is obvious, the listed periodicals in which the results of research carried out by the institutions are published indicate only the major media used. The identity of all the species on which some of the institutions are working could not be determined, as often only popular names, sometimes of genera only, were furnished. The Directory is issued in loose-leaf form to facilitate future corrections and additions. (From introduction)

13928. Houston, Arthur, Jane A. Madden, R. John Woods, and Harry M. Miles (Dept. of Biol., Marquette Univ., Milwaukee, Wisconsin). 1971. SOME PHYSIOLOGICAL EFFECTS OF HANDLING AND TRICAINE METHANESULPHONATE ANESTHETIZATION UPON THE BROOK TROUT, Salvelinus fontinalis. J. Fish. Res. Bd. Canada, 28(5): 625-633.

The effects of handling and anesthetization with tricaine methanesulphonate (Ayerst "Finquel") upon brook trout (Salvelinus fontinalis) have been investigated with reference to selected hematological and cardioventilatory parameters, and several aspects of body fluid chemistry. Alterations in hemoglobin, hematocrit, and total dissolved solids suggest that exposure to the anesthetic prompts a rapid hemoconcentration. Water content increases, and the plasma, tissue, and estimated cellular levels of several of the major electrolytes (sodium, potassium, calcium, and magnesium) are altered. Observations upon cardiac activity, dorsal aortic pressure, and ventilatory rate and amplitude support the hypothesis that Finquel exerts a depressive influence upon central autonomic functions. Handling alone leads to significant changes in plasma glucose and lactate levels, and in the concentrations and distributions of a number of the electrolytes investigated. (Authors)

13929. Houston, Arthur H., Jane A. Madden, R. John Woods, and Harry M. Miles (Dept. of Biol., Marquette Univ., Milwaukee, Wisconsin). 1971. VARIATIONS IN THE BLOOD AND TISSUE CHEMISTRY OF BROOK TROUT, Salvelinus fontinalis, SUBSEQUENT TO HANDLING, ANESTHESIA, AND SURGERY. J. Fish. Res. Bd. Canada, 28(5): 635-642.

Modifications in blood and tissue chemistry of brook trout have been followed during their recovery from handling, tricaine methanesulphonate (Ayerst "Finquel") anesthesia, and experimental preparation. The recovery process was characterized by alterations in the hematological characteristics of the animals, a marked and persistent condition of hyperglycemia, and changes in plasma, tissue and estimated cellular ion concentrations, and equilibrium potentials. Water content remained relatively stable, although variations in distribution took place. The short-term changes observed appeared to be correlated in time with the clearance of anesthetic from the animals, and possibly with a sequence of cardioventilatory-renal reflex responses induced by vascular hypoxia (or hypercapnia). More persistent changes are believed to be related to generalized endocrine responses to the traumatic character of the procedures employed. (Authors)

13930. Walker, C. E., and D. B. Lister (Dept. of Fish. and Forestry of Canada Fish. Serv., Vancouver, British Columbia, Canada). 1971. RESULTS FOR THREE GENERATIONS FROM TRANSFERS OF PINK SALMON (Oncorhynchus gorbuscha) SPAWN TO THE QUALICUM RIVER IN 1963 AND 1964. J. Fish. Res. Bd. Canada, 28(5): 647-654.

Transfers of pink salmon (Oncorhynchus gorbuscha) eggs were made to the Qualicum River in two years, utilizing 5.79 million eggs from Cheakamus River stock in 1963 and 6.85 million eggs from Bear River stock in 1964. Adult returns to the Qualicum River were 100 spawners in 1965, 1967, and 1969; 11,940 in 1966; 3000 in 1968; and 300 in 1970. Differences between the odd- and even-year plants were noted in times of egg-take (equivalent to time of spawning of donor stock), incubation, and fry emigration, lengths of emigrating fry, possibility of losses through predation by herring on estuarine fry, and direction of orientation to the recipient (Qualicum River) stream. Pronounced differences between donor stock in rate of return are thought to be primarily related to differences in spawning times and stream temperature. The decrease in numbers of adults in the even-year generation may have been due to lower freshwater survival during incubation as a result of suspected superimposition of chum salmon on the earlier deposited pink salmon eggs; the loss was estimated to be in the order of 46%. (Authors)

13931. McKim, J. M., and D. A. Benoit (U. S. Environmental Protection Agency, Wat. Qual. Office, Nat. Wat. Qual. Lab., Duluth, Minnesota). 1971. EFFECTS OF LONG-TERM EXPOSURES TO COPPER ON SURVIVAL, GROWTH, AND REPRODUCTION OF BROOK TROUT (Salvelinus fontinalis). J. Fish. Res. Bd. Canada, 28(5): 655-662.

During a 22-month period, all developmental stages of the brook trout (Salvelinus fontinalis) were exposed to copper (Cu(II)) concentrations ranging from 32.5 to 1.9 µg/liter. The highest concentration decreased survival and growth in adult fish and reduced both number of viable eggs produced and hatchability. Survival, growth, and reproductive success of adults in copper concentrations from 17.4 to 3.4 µg/liter did not differ from the control (1.9 µg/liter). Concentrations of 32.5 and 17.4 µg/liter had marked adverse effects on survival and growth of alevins and juvenile fish. Effects of copper on alevins-juveniles from unexposed parents apparently are no different than the effects on alevins-juveniles from parents exposed to copper. The maximum acceptable toxicant concentration (MATC) for brook trout exposed to copper in water with a hardness of 45 mg/liter (as $CaCO_3$) and a pH of 7.5 fell between 17.4 and 9.5 µg/liter copper. The mean 96-hr TL50 for 14-month-old brook trout exposed to copper was 100 µg/liter, and the application factor, MATC/96-hr TL50, lies between 0.17 and 0.10. (Authors)

13932. MacCrimmon, Hugh R. (Dept. of Zool., Coll. of Biol. Sci., Univ. of Guelph, Ontario, Canada). 1971. WORLD DISTRIBUTION OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 28(5): 663-704.

Since 1874, the endemic range of the rainbow trout, Salmo gairdneri Richardson, has been extended through introduction to include eastern North America and the continents of Africa, Asia, Australia, Europe, and South America. The present range of the species extends into low latitudes by the use of waters at high elevations to over 4500 m above sea level. Environmental factors considered to be of primary importance in the survival of introduced populations are water temperature and precipitation. The presence of suitable spawning grounds, coupled with seasonal water temperatures below 13 C, are essential for the establishment of self-sustaining populations. A further extension of the world range of rainbow trout seems unlikely except perhaps into northeastern Asia. However, distribution within the present range is likely to be increased through the use of new ponds and reservoirs as they are constructed for water supply and flood control by many countries throughout the world. The farming of rainbow trout, now of local significance in parts of eastern Asia, western North America, and central and western Europe, offers an unrealized potential on all continents if warranted by a protein and market demand. (Auth.)

13933. Johnson, B. Thomas, C. Richard Saunders, Herman O. Sanders (Bur. Sport Fish. & Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri). 1971. BIOLOGICAL MAGNIFICATION AND DEGRADATION OF DDT AND ALDRIN BY FRESHWATER INVERTEBRATES. J. Fish. Res. Bd. Canada, 28(5): 705-709.

Magnification of persistent pesticides by invertebrates occurred rapidly in fresh water. Invertebrates accumulated residues many thousands of times that of surrounding water after exposure to ^{14}C-labeled aldrin or DDT at levels < 100 pptr (ng/liter). In addition, evidence of marked degradation of these pesticides within specific trophic levels was found. Our studies suggest that aquatic invertebrates influence both the quantity and quality of insecticide residue passed via the fish food chain. (Authors)

13934. Alderdice, D. F., and C. R. Forrester (Fish. Res. Bd. Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. EFFECTS OF SALINITY AND TEMPERATURE ON EMBRYONIC DEVELOPMENT OF THE PETRALE SOLE (Eopsetta jordani). J. Fish. Res. Bd. Canada, 28(5): 727-744.

Newly fertilized eggs were incubated at 13 combinations of levels of salinity and temperature between 20 and 35°/oo, and 4.1 and 8.5 C. Average egg density throughout development was 1.0252, and the incubation period ranged from 6.2 to 13.5 days. Larval length at mean hatching time averaged 2.84 mm for all trials. External features of the larvae are described. The percentages of eggs hatching (total hatch) and producing viable larvae (viable hatch) are examined with respect to salinities and temperatures of incubation. Calculated optima were: total hatch 29.47°/oo S, 6.65 C; viable hatch 27.93°/oo S, 7.00 C. At 6.3, 7.2, and 8.1 C, larvae grew to 5.5-5.7 mm total length prior to exhaustion of yolk 246-393 hr after hatching. It was concluded that greatest numbers of viable larvae of largest size at yolk exhaustion would occur from incubation at 27.5-29.5°/oo S and 6-7 C. Laboratory results are related to available hydrographic and meteorological data for a spawning area off the west coast of Vancouver Island. Estimates are given of direction, depth, and duration of drift of the pelagic stages until exhaustion of the yolk. Environmental variability in the spawning period is related to existing measures of year-class strength. Effect of temperature on egg development is related to the range of the species in terms of estimated temperatures available at spawning depths. (Authors)

13935. Ott, A. G., and H. F. Horton (Dept. of Fisheries and Wildlife, Oregon State Univ., Corvallis, Oregon). 1971. FERTILIZATION OF CHINOOK AND COHO SALMON EGGS WITH CRYO-PRESERVED SPERM. J. Fish. Res. Bd. Canada, 28(5): 745-748.

Techniques were developed that resulted in the fertilization of fresh eggs of spring chinook salmon (Oncorhynchus tshawytscha) and coho salmon (O. kisutch) with sperm frozen 7 days in liquid nitrogen (−196 C). Maximum fertilities obtained were 38 and 79%, respectively. Best results for coho salmon were achieved when mannitol and dimethyl sulfoxide were included in the extender, and when no time was allowed for equilibration of the fresh sperm in the extender. This is the first success reported in preserving viable sperm of these two species at subfreezing temperatures. (Authors)

13936. McCart, P., and V. A. Pepper (Dept. of Biol., Univ. of Sask., Regina Campus, Regina, Saskatchewan, Canada). 1971. GEOGRAPHIC VARIATION IN THE LATERAL LINE SCALE COUNTS OF THE ARCTIC GRAYLING, Thymallus arcticus. J. Fish. Res. Bd. Canada, 28(5): 749-754.

An examination of Arctic grayling (Thymallus arcticus) collected on either side of the continental divide (Brooks Range) in Alaska revealed that lateral line scale counts were significantly higher on the North Slope than in the Yukon Basin to the south. An examination of geographic variation in this character within the North American range of the species suggested a division into three geographic areas: an area of uniformly low mean counts in the Bering Sea-North Slope of Alaska; an area of uniformly high counts in the remainder of Alaska and parts of the Yukon Territory and British Columbia; an area of variable mean counts in the Northwest Territories. Only two glacial refugia need be postulated to explain

this pattern if it is assumed that populations in the first and last of these areas have a similar Mississippian origin and the high count populations a Beringian origin. (Authors)

13937. Barica, Jan (Fish. Res. Bd. Canada, Freshwater Inst., Winnipeg 19, Manitoba, Canada). 1971. A RAPID METHOD OF DETERMINING AMMONIUM IN WATER WITH A UNIVALENT CATION GLASS ELECTRODE. J. Fish. Res. Bd. Canada, 28(5): 759-764.

The use of a univalent cation glass electrode for determining ammonium in water is described. The method enables direct determination of ammonium ion in concentrations above 0.5 mg/liter without any dilution or pretreatment of sample. A constant background of Na^+ and K^+ in samples is required, with concentration of potassium being lower than that of ammonium. For several types of natural and enriched waters with ammonium content up to 40 mg/liter NH_4-N, the mean error by the method was $\pm$ 4.9%. (Auth.)

13938. Baum, E. T., and A. L. Meister (Atlantic Sea Run Salmon Comm., Univ. of Maine Campus, Bangor, Maine). 1971. FECUNDITY OF ATLANTIC SALMON (Salmo salar) FROM TWO MAINE RIVERS. J. Fish. Res. Bd. Canada, 28(5): 764-767.

Estimates of numbers of eggs in 164 hatchery-spawned Atlantic salmon (Salmo salar) from two Maine rivers ranged from 3528 to 18,847, and egg number per pound of total body weight from 523 to 1385. Sample autopsies of 10 salmon revealed that artificial spawning removed an average of more than 97% of the eggs in the body cavity. There was no significant difference between von Bayer and displacement estimates of fecundity. Valid estimates of the potential egg deposition of Atlantic salmon runs in the two Maine rivers studied can be made using routinely collected trapping data and the regression formulae based on fish length resulting from this study. Salmon that spent 2 years at sea before spawning contained lower total numbers of eggs but appeared to have a higher rate of fecundity than older fish. Factors governing egg size could not be isolated. Loss in body weight during spawning is discussed. (Authors)

13939. Arai, Hisao P. (Dept. of Biol., Univ. of Calgary, Calgary, Alberta, Canada). 1971. HELMINTH PARASITES OF EMBIOTOCID FISHES. II. A NEW SPECIES OF Labrifer (DIGENEA: LEPOCREADIIDAE) FROM Zalembius rosaceus FROM CALIFORNIA. J. Fish. Res. Bd. Canada, 28(5): 767-769.

Labrifer balli n. sp. from an embiotocid fish, Zalembius rosaceus (Jordan and Gilbert), is described and illustrated. The main features that differentiate the present form from those previously described in the genus are the shape of the body and the position and orientation of the oral sucker. (Auth.)

13940. Skauen, D. M., N. Marshall, and R. J. Fragala (School of Pharmacy, Univ. of Conn., Storrs, Connecticut). 1971. A LIQUID SCINTILLATION METHOD FOR ASSAYING ^{14}C-LABELLED BENTHIC MICROFLORA. J. Fish. Res. Bd. Canada, 28(5): 769-770.

A simple and reliable method for assaying ^{14}C-labelled benthic microflora is described. Powdered core samples are suspended in Cab-O-Sil gel and ^{14}C activity determined in a liquid scintillation spectrometer. (Authors)

13941. Houston, Arthur H. (Dept. of Biol., Marquette Univ., Milwaukee, Wisconsin). 1971. A SIMPLE IMPROVEMENT IN THE VASCULAR CATHETERIZATION PROCEDURE FOR SALMONID AND OTHER TELEOST FISHES. J. Fish. Res. Bd. Canada, 28(5): 781-783.

A simple method is described, by means of which a sharpened hematocrit tube is used as a trocar to assist in the placement of untipped vascular catheters in relatively small fishes with minimum blood loss. (Auth.)

13942. Kwain, Wen-hwa (Res. Branch, Ontario Dept. of Lands and Forests, Sault Ste. Marie, Ontario, Canada). 1971. LIFE HISTORY OF RAINBOW TROUT (Salmo gairdneri) IN BATCHAWANA BAY, EASTERN LAKE SUPERIOR. J. Fish. Res. Bd. Canada, 28(5): 771-775.

The life history of a rainbow trout (Salmo gairdneri) population was inferred from scale readings from the years 1967-70. Of 461 scale samples examined, 58% were from fish spending 2 years in the stream, 38% were 1 year in the stream, and 4% were 3 years in the stream. Three- and four-year-old trout formed the bulk of the spawning population. Fish descending early to the lake were significantly larger at maturity than fish descending later in life. No apparent size difference between sexes was found; fish generally spent 2 years in the lake to reach sexual maturation. In the spawning population, 68% were maiden spawners and 26% were spawning for a second time. A five-time spawner was recorded. The incidence of lamprey marking of rainbow trout was 15% (1969) and 14% (1970). Ninety percent of lamprey-marked trout were larger than 450 mm in fork length and had lived in the lake for 2 or more consecutive years. (Auth.)

13943. Uthe, J. F., and E. G. Bligh (Fish. Res. Bd. Canada, Freshwater Inst., Winnipeg 19, Manitoba, Canada). 1971. PRELIMINARY SURVEY OF HEAVY METAL CONTAMINATION OF CANADIAN FRESHWATER FISH. J. Fish. Res. Bd. Canada, 28(5): 786-788.

The concentration of 13 toxic elements in dressed fish from a nonindustrialized and heavily industrialized freshwater area have been measured. With the exception of mercury, in no instance did levels exceed limits set by regulatory agents for lead, arsenic, copper, and zinc. Indeed in the majority of instances the levels from the industrialized area did not differ significantly from those of the non-industrialized area. (Authors)

13944. Ellender, R. D., Carl Lee Armour and Bennie Joe Camp (Veterinary Microbiol. Dept., Texas A & M Univ., College Sta., Texas). 1971. ANALYSIS OF AMMONIUM-NITROGEN IN ARTIFICIAL SEAWATER AQUARIA. J. Fish. Res. Bd. Canada, 28(5): 788-789.

A technique for analysis of ammonium-nitrogen in artificial seawater aquaria is described. The method, suitable for measuring ammonium concentrations in the 1-20 μg/ml range, involves diffusion and colorimetry. (Authors)

13945. Lin, Y. S., W. Chiang, Y. P. Li, and C. Y. Jaw (Dept. of Zool. and Inst. of Fish. Biol., National Taiwan Univ., Republic of China). 1971. PHOSPHORUS DYNAMICS IN CHUPEI FISH PONDS. Chinese-American Joint Comm. on Rural Reconstruction, Fisheries Series No. 11, pp. 36-59.

13946. Antychowicz, Jerzy, and Jacek Roszokowski (The Veterinary Institute Pulawi, Poland). 1971. HISTOPATHOLOGICAL CHANGES IN CARP SWIM BLADDER DISEASE. Riv. It. Pìscic. Ittiop., 6(1): 5-8, illus.

Carp swim bladder disease is more frequent in the last several years than ever before. The purpose of the presented investigations was to compare histo-pathological changes in swim bladder of carp which developed the disease in ponds, with lesions produced by experimental bacteria infection. Diseased swim bladders were generally enlarged and deformed. A disproportion in size of the anterior and posterior swim bladder chambers was more or less distinctive almost in each case. Depending on the stage of the disease the swim bladder walls showed various thickening. In the extreme cases, because of wall thickening, the swim bladder lumen was so narrow that it appeared cleftlike. Dilation and congestion of blood vessels were seen, as well as disseminated spots of brown or black. Adhesions of the swim bladder wall with the surrounding organs were also noted. In the majority of cases the epithelium lining the swim bladder chambers became simple cuboidal or simple columnal. Vacuolisation and cytoplasm destruction were often seen in epithelial cells. Occasionally, eosinophilic granules were observed in enlarged epithelial cells. In some instances epithelium was found to be separated from the lamina propria. The most intensive histopathological changes were found in the medium layer. The oedema of connective tissue and congestion of the vascular

system caused marked thickening of this layer. Among collagenic fibers, erythrocytes, leucocytes, lymphocytes and histiocytes were seen. In more advanced stages of the disease extensive extravasationes and a few necrotic focuses were detected. Swim bladder disease can be considered as an inflammatory process accompanied by proliferative changes in the bladder wall. Transformation of epithelial cells and distinctive lesions in the medium layer seem to be the most characteristic feature of this disease. It can be supposed that the infective agent enters the swim bladder through the pneumatic duct or through the blood vessels. The lack of essential differences in morphological changes in swim bladders of naturally and experimentally infected carp seems to support the bacteriological theory of the disease, though it does not exclude the possibility of the existence of other etiological agents which are able to cause similar lesions. (From authors)

13947. Grimaldi, E. (Istituto Italiano di Idrobiologia, 28048 Verbania Pallanza, (Novara), Italy). 1971. HEAVY MORTALITIES INSIDE THE POPULATIONS OF BLEAK (Alburnus alborella) IN THE LAKES OF NORTH ITALY, CAUSED BY A GILL INFECTION DUE TO FUNGI OF THE GENUS Branchiomyces. Riv. It. Piscic. Ittiop., 6(1): pp. 11-14, illus.

In recent years heavy losses occurred among the bleaks (Alburnus alborella) of some large North Italian lakes. They have been caused by a gill infection due to fungi belonging to the genus Branchiomyces. The epidemics were observed on Lake Varese (July 1964), Lake Maggiore (July 1968 and 1970), Lake Lugano (September 1970); in the last case the mortality has been roughly evaluated at 20-50 tons. All the epidemics coincided with high temperatures (more than 20°C) in the most superficial waters, as well as with algal blooms. Fungal elements are particularly abundant along the gill arches and the longitudinal axes of gill filaments, where they account for a macroscopic blackish variegation. According to its morphometric characteristics the Branchiomyces found in bleaks does not apparently correspond to either species reported in the literature (B. sanguinis and B. demigrans); however, the subject claims for a more accurate control. Up to now Branchiomyces infections were apparently known only in ponds and small lakes. The very reasons for the recent appearance of this disease in water bodies as large as Lake Maggiore (212.2 km^2) and Lake Lugano (48.9 km^2) are not easily understood. However, this event seems to be connected in some way with the rapid eutrophication occurring in North Italian lakes. (Auth. summ.)

13948. Reichenbach-Klinke, H.-H. (Zoological-Parasitological Inst., Univ. of Munich, West Germany). 1971. ON A NEW DISEASE OF THE SKIN OF SALMONIDS IN CENTRAL EUROPE. Riv. It. Piscic. Ittiop., 6(1): pp. 17-18.

A new spot-disease, Ulcerative Dermal Necrosis (UDN) is described, first recognized in Ireland 1964, then in Scotland and since 1969 in several rivers north of the Alps. In first degree grayling, brown trout, brook trout, hucho, in few cases powan and pike, are affected. The main symptoms are shallow ulcers, soon after infected by fungi, and degenerations at the head. The infection is spreading in wild waters, it must therefore be warned before the introduction of the disease into pond cultures. (Auth. summ.)

13949. Eslami, A. H., and M. Anwar (Dept. of Parasitology, Univ. of Tehran, Fac. of Vet. Medicine, P. O. Box 3262, Tehran, Iran). 1971. OCCURRENCE AND INTENSITY OF THE INFESTION BY Caryophyllaeus fimbriceps IN CARP AND MULLET (NEW HOST) IN IRAN. Riv. It. Piscic. Ittiop., 6(1): 21-23.

Caryophyllaeus fimbriceps was first reported in fresh water fish (wild carp, carp and bream) from the U. S. S. R. by Annenkova-Khlopina (1919). Due to the economic importance of the fishing industry in Iran and the pathogenicity of this parasite, it has been considered necessary to investigate its occurence in Iran. In carp, 18 out of the total examined were found to be infested by C. fimbriceps (15.8%), while only one mullet had the parasite. It can be said that the Caspian coast is an infected area, as all the fish for this study were caught here. Since C. fimbriceps was found in mullet, this fish can be regarded as a new host for the parasite.

13950. Schultz, R. Jack, and Robert Rush Miller. 1971. SPECIES OF THE Poecilia sphenops COMPLEX (PISCES: POECILIIDAE) IN MEXICO. Copeia, No. 2, pp. 282-290, illus.

Poecilia sphenops alternately has been cast as several (or many) species, or a single polytypic species. Laboratory, field, and morphological evidence gathered mainly from a mixed population of mollies in southern Mexico, but also from other parts of Mexico and Guatemala, indicates that "Poecilia sphenops" is not a single species but a complex of unknown magnitude. The name Poecilia butleri is resurrected from synonymy for the Pacific representative of P. mexicana in Mexico and southern Guatemala. A natural hybrid between P. sphenops and P. butleri is described. (Authors)

13951. Bechtel, Timothy J., and B. J. Copeland (Dept. of Zool., No. Carolina State Univ., Raleigh, North Carolina). 1970. FISH SPECIES DIVERSITY INDICES AS INDICATORS OF POLLUTION IN GALVESTON BAY, TEXAS. Contributions in Marine Science, Vol. 15, pp. 103-132.

Fish species diversity indices (natural bels/individual) calculated for both fish weights and numbers from trawl collections were found to be useful indicators of environmental and pollution stress in Galveston Bay, Texas. Diversity values ranged from 2.2 in the Texas City-Galveston area to 0.02 in the Houston Ship Channel. Thus it is demonstrated that the concept of using species diversity to indicate adverse water quality conditions is applicable to the higher trophic levels of an estuary. Significant differences were detected in diversity between areas of the bay within each sampling period except in winter as well as between seasons. Also, significant differences between the weight and number indices existed, indicating that both biomass and numbers of organisms should be utilized when studying the diversity of higher trophic levels. Correlation of diversity with percent waste water indicated that those areas receiving the greatest amounts of effluents and toxic materials (up to 86% effluent by volume) exhibited the lowest mean annual diversities. Fish diversity in the Houston Ship Channel above Baytown, Texas can be used to predict diversity in the bay because of the linear relationship between distance and dilution of the ship channel effluent (19 % effluent by volume calculated for Bolivar Roads). Sampling throughout the system indicated that the fish populations could be divided into somewhat separate communities, each structured as a response to environmental and pollution stress. In those areas receiving the greatest stress, the bay anchovy, Anchoa mitchilli, was the dominant species. These same areas also supported the fewest numbers of large individuals. (Authors)

13952. Yu, Shaw L. 1970. AERATOR PERFORMANCE IN NATURAL STREAMS. J. Sanitary Engineering Div., Proc. of Amer. Soc. of Civil Engineers, Vol. 96, No. SA5, pp. 1099-1114; Eutrophication Abstracts No. 23, p. 15, 1971.

The oxygen transfer efficiency of a commercially available surface mechanical aerator and diffuser aerator was tested on Passaic River (New Jersey). Both types of aerators were found to be substantially less efficient in the natural stream than in tanks or lagoons. Average transfer rates of the mechanical and the diffuser aerators were 2.1 and 1.2 lb of oxygen per hp-hr, respectively. The efficiency of both aerators increased with a higher rate of river discharge. The estimates of DO at the aerator corresponded to the average of upstream and downstream DO readings. In designing a river aeration system it is essential to know the aerator's performance in the given stream. Examples illustrate conversions of specific standard transfer rates, commercially specified, to actual conditions. (Auth.)

13953. Graynoth, E. 1970. THE EXPERIMENTAL WINTER ANGLING SEASON LAKES BENMORE AND AVIEMORE 1969. N. Z. Marine Dept. Fisheries Technical Report No. 58, 21 p.

An experimental winter fishing season was applied to Lakes Benmore and Aviemore, hydroelectric reservoirs in New Zealand. It was reasoned that in Benmore the increased take would thin out the population and reduce competition for food thereby increasing growth rates and condition of brown trout and rainbow trout. Results are uncertain as yet.

13954. Beeston, Michael D. 1970. CRUSTACEANS AND FISHES IN THE SEA GRANT PONDS. Studies of marine estuarine ecosystems developing with treated sewage wastes, pp. 272-279; National Sci. Foundation, Sea Grants Project Div. and No. Carolina Bd. of Sci. and Techn., Ann. Report 1969-70; Eutrophication Abstracts No. 22, p. 16, 1970.

Several methods were used to sample crustaceans and fish in control and sewage-enriched ponds. Large shrimp, Benaeus aztecus and P. duorarum, were found only in control ponds; small shrimp Palaemonetes pugio, and blue crab, Calinectes sapidus, were present in all ponds. Spot, pinfish, croaker, flounder, silversides, and anchovies were found only in the control ponds. Spot was the only species caught in numbers sufficient to estimate its biomass. One of the control ponds harbored Aegathoa oculata, a crustacean parasitizing on anchovies. The fish population of waste ponds consisted largely of minnows, Fundulus heteroclitus being the predominant species. (Auth.)

13955. Booth, Gary M., and Gregory S. Whitt (Dept. of Entomology, Univ. of Ill., Urbana, Illinois). 1970. HISTOCHEMICAL SPECIFICITY OF CHOLINESTERASES TO PHENYLTHIOACETATE IN DIFFERENTIATED NEURAL TISSUES OF INSECTS AND TELEOSTS. Tissue & Cell, 2(4): 521-528.

Housefly brain cholinesterase was histochemically demonstrated to hydrolyse phenylthioacetate at a very high rate, similar in distribution to that previously reported for acetylthiocholine. However, teleost neural retina cholinesterase would not hydrolyse the aromatic substrate, but the enzyme did cleave acetylthiocholine. Paraoxon and eserine were utilized to show selective patterns of inhibition in the two tissues. This high degree of substrate selectivity is discussed in conjunction with the possible development of selective insecticides. (Authors)

13956. Ryland, J. S., and J. H. Nichols (Fisheries Lab., Lowestoft, England). 1967. EFFECT OF TEMPERATURE ON THE EFFICIENCY OF GROWTH OF PLAICE PROLARVAE. Nature, 214(5087): 529-530.

The survival of eggs and larvae of the plaice (Pleuronectes platessa L.) in the North and Irish Seas is currently being investigated. Though many of our results are of relevance mainly to the problem of aging larvae in connection with the survival investigations, one particular relationship has emerged which is of considerable interest and practical importance. The observations concern the efficiency of yolk utilization in prolarvae hatched from artificially fertilized eggs of southern North Sea plaice. Rate of yolk utilization increases pari passu with temperature in a rectilinear manner. Rates of growth in length at each temperature were also linear for the short period of 7-10 days which was considered. Unlike yolk utilization rates, however, growth rates at first increase with temperature to attain a peak at 8°C and then sharply decline. It appears that there is an optimum temperature for yolk utilization which produces maximal growth. This is a very significant consideration for those concerned with the development of mass rearing techniques for marine food fishes.

13957. Ryland, J. S. (Fisheries Lab., Lowestoft, England). 1966. OBSERVATIONS ON THE DEVELOPMENT OF LARVAE OF THE PLAICE, Pleuronectes platessa L., IN AQUARIA. J. Cons. perm. int. Explor. Mer., 30(2): 177-195.

An experiment is described in which plaice larvae were hatchery reared to metamorphosis at temperatures corresponding to those found concurrently in the southern North Sea. The arbitrary developmental stages recognized for plaice larvae are defined and their mean durations determined. Development proceeds together with growth in length and in weight, and all were clearly related to age in this experiment. (Auth.)

13958. Lux, Fred E. (Nat. Mar. Fish. Serv. Biol. Lab., Woods Hole, Massachusetts). 1971. AGE DETERMINATION OF FISHES (REVISED). U. S. Department of Commerce, NOAA, NMFS, Fishery Leaflet 637, 7 p., illus. Revision of Fishery Leaflet No. 488.

13959. Schultz, R. Jack (Ecology Section, Biol. Sci. Group, Univ. of Conn., Storrs, Connecticut). 1971. SPECIAL ADAPTIVE PROBLEMS ASSOCIATED WITH UNISEXUAL FISHES. Am. Zoologist, Vol. 11, 351-360.

Two genera of fishes, Poecilia and Poeciliopsis, both in the family Poeciliidae, have established unisexual populations. One "species", Poecilia formosa, is a diploid form that relies upon sperm from Poecilia latipinna or P. mexicana to initiate parthenogenetic development (gynogenesis). Triploid individuals of P. formosa have also been discovered but the mode of reproduction and the significance of such fish to natural populations have yet to be established. In the genus Poeciliopsis three gynogenetic triploids are known. Each is superimposed on a different bisexual host: Poeciliopsis lucida, P. monacha or P. viriosa. Five diploid hybridogenetic forms also have been identified. These are fertilized by eithe P. lucida, P. latidens, or P. occidentalis. In hybridogenetic forms, sperm actually fertilizes the egg. A hybrid with maternal and paternal characters is produced, but only maternal genes are transmitted through the egg to the next generation. Because of their sperm dependency, all unisexual fishes must reside with at least one of the parental species. They are forced to compete with them for sperm, space, and other limited resources. The ability to produce two females for every one that bisexuals produce suggests that the unisexuals have the potential to win this competition; but in so doing, they would lose their sexual support and eliminate themselves. A density-dependent mate selection system plays a role in establishing a workable balance between the competing elements. Unisexual forms of both Poecilia and Poeciliopsis are of hybrid origin. For most of them, the parental precursors and the proportion of genetic material that each contributed to the unisexual is known. The various genomes that make up the unisexuals are adapted to a variety of habitats. Once these genomes are combined in a unisexual hybrid, potential for adaptation to multiple niches exists; this coupled with heterosis contributes greatly to the success of gynogenetic and hybridogenetic fishes. (Auth. synopsis)

13960. Kilgen, Ronald H., and R. Oneal Smitherman. (Dept. of Biol. Sciences, Nicholls State Univ., Thibodaux, La.). 1971. FOOD HABITS OF THE WHITE AMUR STOCKED IN PONDS ALONE AND IN COMBINATION WITH OTHER SPECIES. Progr. Fish Cult., 33(3): 123-127.

White amur (Ctenopharyngodon idellus), also known as grass carp, were stocked alone in ponds at rates of 20, 40, 80, and 160 per acre to determine efficient stocking rates for controlling undesirable aquatic plants. Several aquatic plants were stocked in the ponds, including waterhyacinth, alligatorweed, Eurasian milfoil, Potamogeton sp., and Chara spp. Stocking rates of 40 or more fingerlings per acre eliminated milfoil, Potamogeton, and Chara, and caused a decrease in waterhyacinth. Alligatorweed was not affected by any stocking rate. The diet of white amur, determined by stomach analyses, consisted mainly of macrophytes and algae (75% to 95% by volume), and relatively few insects (0% to 18%). White amur were also stocked at a rate of 50 per acre in combination with channel catfish, largemouth bass, redeye bass, spotted bass, Israeli carp, and fathead minnows, to evaluate competition and growth of these species when stocked together. In general, it seems that the food habits of white amur are not at all similar to the other fish species in this experiment. The food of white amur consisted mainly of macrophytes (84%), which were probably roots and stolons of centipedegrass from the edge of the pond. White amur were observed nibbling centipedegrass with their heads out of water. Insects (chironomid larvae) comprised only 9% of the food. Other fish species were mainly insectivorous: Israeli carp (75%), largemough and spotted bass (77%), redeye bass (85%), and channel catfish (62%). White amur resort to eating insects only when plants are scarce or unavailable. (Authors)

13961. FAO of the United Nations (Rome, Italy). 1971. REPORT OF THE SIXTH SESSION. ADVISORY COMMITTEE ON MARINE RESOURCES RESEARCH. FAO Fisheries Reports, No. 106, 30 p.

13962. Prowse, G. A. (Tropical Fish Cult. Res. Inst., Malacca, Malaysia). 1971. EXPERIMENTAL CRITERIA FOR STUDYING GRASS CARP FEEDING IN RELATION TO WEED CONTROL. Progr. Fish Cult., 33(3): 128-131.

Evidence is given in favor of grass carp (Ctenopharyngodon idellus) being primarily a herbivore. Grass carp have a pharyngeal structure highly adapted to tearing plant material. They have been and are being used successfully in several countries to control aquatic weeds. The selective bias of a fish for a particular food under specific conditions is discussed. Factors to consider in the design of experiments on grass carp feeding are as follows: (1) age and size of fish, (2) the normal selectability of aquatic weeds, (3) temperature, (4) seasonal effect, (5) size of pond and stocking density, (6) oxygen, (7) stress effects, (8) water flow, and (9) previous feeding history. Experiments should be designed to show the effect and degree of interaction of the various factors.

13963. Smith, R. R. (Bur. Sport Fish. & Wildl., Western Fish Nutrition Lab., Hagerman Field Sta., Hagerman, Idaho). 1971. A METHOD FOR MEASURING DIGESTIBILITY AND METABOLIZABLE ENERGY OF FISH FEEDS. Progr. Fish Cult., 33(3): 132-134.

Metabolism chambers were used to collect separately feces, urine, and gill excretions from rainbow trout weighing 250 to 500 g. The fish were force fed measured quantities of feed daily and waste products were collected for 5 days. Apparent digestibility, metabolizable energy, and nitrogen balance were calculated. Some problems were encountered, but the method had value in measuring availability and utilization of fish feeds. (Auth.)

13964. Allen, Kenneth O., and James W. Avault, Jr. (Fish. Div., School of Forestry and Wildlife Management, La. State Univ., Baton Rouge, Louisiana). 1971. NOTES ON THE RELATIVE SALINITY TOLERANCE OF CHANNEL AND BLUE CATFISH. Progr. Fish Cult., 33(3): 135-137.

In aquariums, blue catfish (Ictalurus furcatus) had a significantly greater salinity tolerance ($P < .05$) than channel catfish (I. punctatus) of a similar age and size. Fish of both species took food at 14 ppt salinity but they lost weight and mortalities were heavy over the 37-day test period. Blue catfish also exhibited a greater ability to reacclimate back to fresh water from saline water. (Authors)

13965. Fromm, Paul O., Brent D. Richards, and Robert C. Hunter (Dept. of Physiology, Mich. State Univ., East Lansing, Michigan). 1971. EFFECTS OF SOME INSECTICIDES AND MS-222 ON ISOLATED-PERFUSED GILLS OF TROUT. Progr. Fish Cult., 33(3): 138-140.

Isolated gills of rainbow trout (Salmo gairdneri) were perfused with a sodium deficient Ringer solution in the presence of various pesticides and MS-222 and flow rates were determined. This was followed by perfusion with india ink and preparation for histological determination of fluid flow patterns through the branchial vasculature. Short-term (acute) exposure to dieldrin, rotenone, malathion, and MS-222 resulted in a statistically significant reduction in perfusion flow rate through the isolated gills. Exposure of gills to 1 ppm methoxychlor was without effect. Results of india ink perfusions indicated that decrease in rate of fluid flow through the gills correlated well with increased lamellar perfusion. (Authors)

13966. Maxwell, Riney, and Alban R. Essbach (Fish. Div., Game and Fish Dept., Phoenix, Arizona). 1971. EGGS OF THREADFIN SHAD SUCCESSFULLY TRANSPORTED AND HATCHED AFTER SPAWNING ON EXCELSIOR MATS. Progr. Fish Cult., 33(3): p. 140.

Threadfin shad (Dorosoma petenense) were induced to spawn on "mats" constructed of standard poultry wire filled with aspen excelsior. The mats were about 2 feet square; others were 2 feet wide by 1 foot deep. Profuse spawning occurred directly on the excelsior strands. The mats were transported 250 miles from Lake Pleasant to Lake Powell, Arizona, (a 6-1/4 hour trip) where they were suspended under a dock and on buoys. Successful hatching of the eggs was observed by scuba divers. An estimated 200,000 shad larvae were successfully introduced in Lake Powell in two trips with a pickup truck and a 100-gal tank. (Authors)

13967. Primbs, E. R. J. 1971. EVIDENCE FOR THE NONESSENTIALITY OF ASCORBIC ACID IN THE DIET OF RAINBOW TROUT. Progr. Fish Cult., 33(3): 141-149.

Tests were applied to 11-month-old rainbow trout to determine whether ascorbic acid is essential in their diet. Tests showed that the experimental fish were depleted of ascorbic acid significantly below a level of the control trout; however, no effects could be detected upon growth, formation and replacement of collagen, haematological condition, spleen development, fat metabolism, or mortality rate. Specifically, lordosis and scoliosis failed to develop in 11-month-old fish. There is evidence that the development of scoliosis and exophthalmus in the 2-month-old fish is attributable to hypervitaminosis A and not to hypovitaminosis C. It is hypothesized that the results of others that show the dietetic requirement of ascorbic acid by the salmonids are caused by an interrelation of ascorbic acid with vitamin A. (Auth.)

13968. Brauhn, James L. (Bur. Sport Fish. & Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri). 1971. FALL SPAWNING OF CHANNEL CATFISH. Progr. Fish Cult., 33(3): 150-152.

Age class II channel catfish (Ictalurus punctatus) were spawned under laboratory conditions in August and November. The spawning technique included long-term holding at 17.2°C, feeding a high-protein diet, gradual elevation of water temperature to 25.9°C, and ovulation induction by injecting macerated carp pituitary. The technique is useful in providing fingerling channel catfish for mid-winter research or spring stocking of ponds. (Auth.)

13969. Keller, Walter T., Wallace C. Gay, and Bruce D. White (N. Y. Dept. of Environmental Cons., Ray Brook, New York). 1971. SIMPLIFIED TENDING OF SMALL TRAP AND FRAME NETS. Progr. Fish Cult., 33(3): p. 152.

The idea of using nylon zippers was a simple solution for removing small catches of fish from 4-foot Oneida Lake trap nets and a small frame net. The bottom of the nets were fitted with zippers to provide an opening for dumping the fish. Tending time was reduced considerably.

13970. Royer, L. M. (Sask. Fish. Lab., Saskatoon, Saskatchewan, Canada). 1971. COMPARATIVE PRODUCTION OF PIKE FINGERLINGS FROM ADULT SPAWNERS AND FROM FRY PLANTED IN A CONTROLLED SPAWNING MARSH. Progr. Fish Cult., 33(3): 153-155.

Northern pike fingerling production was studied over a 7-year period in a controlled spawning marsh at Kenosee Lake, Saskatchewan. Production rates when adult spawners were stocked varied from 1,038 to 1,570 fingerlings per acre of marsh during 4 years of operation. When hatchery reared fry were stocked in the marsh, fewer than two fingerlings per acre were produced during 2 years of study. Data on the emigration of fingerlings are presented and possible factors responsible for the low survival of hatchery fry are discussed. (Auth.)

13971. White, George E. (Texas Parks and Wildl. Dept., State Fish Hatchery, Jasper, Texas). 1971. THE TEXAS GOLDEN GREEN: A COLOR MUTATION OF THE GREEN SUNFISH. Progr. Fish Cult., 33(3): p. 155.

A golden color mutation of the green sunfish Lepomis cyanellus has been found and developed at the Jasper State Fish Hatchery. Studies are being conducted on the utilization of the Texas golden green as a forage fish. (Auth.)

13972. Houde, Edward D., and Andrew J. Ramsay (Bur. of Comm. Fish., Tropical Atlantic Biol. Lab., Miami, Florida). 1971. A CULTURE SYSTEM FOR MARINE FISH LARVAE. Progr. Fish Cult., 33(3): 156-157.

A culture system is described that has been successful in rearing several species of larvae of pelagic marine fish. The culture tank is a 350-gal cylindrical polyethylene container. A constant-level siphon allows seawater exchange in the system. Aeration and circulation are provided by a ring of perforated air hose on the bottom of the tank. (Authors)

13973. Oseid, Donavon M., and Lloyd L. Smith, Jr. (Dept. of Entomology, Fish., and Wildl., Univ. of Minn., St. Paul, Minnesota). 1971. SURVIVAL AND HATCHING OF WHITE SUCKER EGGS AT VARIOUS DISSOLVED OXYGEN LEVELS. Progr. Fish Cult., 33(3): 158-159.

In 1966, white sucker eggs (Catostomus commersonnii) were subjected to dissolved oxygen levels of 3, 5, and 7 ppm at 12.3°C. Hatch was completed in 15 days and 14 days were required for 95 percent hatch at all levels. Sucker eggs in 1967 were incubated at 3 and 6 ppm dissolved oxygen and at 12.9°C. and required 15 and 13 days respectively to complete hatch. Completion of 95 percent hatch was attained in 13 and 11 days. Survival ranged from 19.9 to 28.5 percent in 1967 with the lower survival at the higher oxygen concentration. In 1966 survival ranged from 18.3 to 24.2 percent. The mean length of suckers at time of hatching was 0.4 to 0.6 millimeter (4.1 to 7.2 percent) smaller at low than at high oxygen levels.

13974. Davis, Clarence W. (Bur. of Comm. Fish. Biol. Lab., West Boothbay Harbor, Maine). 1971. MARKING SMALL ATLANTIC HERRING WITH BIOLOGICAL STAINS. Progr. Fish Cult., 33(3): 160-162.

Small Atlantic herring (Clupea harengus harengus) 31 to 54 mm long, were stained by immersion in seawater solutions of Bismarck brown Y and neutral red. Staining mortality was negligible in 4 out of 5 tests with Bismarck brown Y, but excessive with neutral red after 3 days. Color retention of both stains was visually good for at least 6 days and fair at 10 to 15 days. (Auth.)

13975. Vincent, Richard (Fish. Div., Montana Fish and Game Dept., Bozeman, Montana). 1971. RIVER ELECTROFISHING AND FISH POPULATION ESTIMATES. Progr. Fish Cult., 33(3): 163-169.

This paper was prepared to meet the need for a uniform easy-to-use procedure for sampling and estimating standing crop, age structure, mortality, and production of fish populations in streams. Techniques are described that consider the types of electric current, electrode arrangement, water conditions influencing electrofishing, and formulas for population estimation. Also, information is given on safety and first-aid.

13976. Espinosa, F. A., Jr., and James E. Deacon (Dept. of Biol. Sci., Univ. of Nevada, Las Vegas, Nevada). 1971. COMPARATIVE ANGLER SUCCESS AT LAKE MEAD (ARIZONA-NEVADA). Progr. Fish Cult., 33(3): 170-174.

Creel census data compiled on the Lake Mead fishery from 1964 to 1967 by the Arizona and Nevada Fish and Game Departments were segregated into catch-per-unit effort data for two angling methods, live bait and artificial lure, and reduced to useable statistics for analysis of comparative angler success. Catch-per-hour data were transformed according to the expression--log [(catch-per-hour x 100)] and processed according to an analysis of variance program defined as a mixed model with two random factors, years and geographical strata, and one fixed factor, angling method. Analysis of variance revealed that the main effects of strata and angling method are statistically significant. The difference in catch-per-hour between anglers fishing with live bait and those using artificial lures is highly significant ("F" = 23.92, $P<0.01$). Anglers using artificial lures enjoy a significantly higher catch rate at Lake Mead than do anglers using live bait. There was no significant effect of years on catch-per-unit effort; however, the interactive effect of years and strata was significant. Catch rates did differ significantly between the three geographical strata during the period from 1965 to 1967. Anglers using artificial lures at Lake Mead enjoy higher catch rates because they are probably a more skillful group than the live bait anglers. (Authors)

13977. Toney, Donald P. (Bur. Sport Fish. & Wildl., Manchester National Fish Hatchery, Manchester, Iowa). 1971. SOFT EGG DISEASE AND ACRIFLAVINE. Progr. Fish Cult., 33(3): p. 159.

13978. Netsch, Norval F., Alfred Houser, and Louis E. Vogele (Bur. Sport Fish. and Wildl., So. Central Reservoir Investigations, Fayetteville, Arkansas). 1971. SAMPLING GEAR FOR LARVAL RESERVOIR FISHES. Progr. Fish Cult., 33(3): 175-179.

A description is presented of gear that has been successfully used to quantitatively sample larval fishes in reservoirs. The boat is 20 feet in length and is powered with a 120-hp stern drive unit. A stanchion assembly and a gasoline-powered winch are used to facilitate handling of a planing type depressor and a 1-meter diameter, cone-shaped, 1/32-inch mesh net. Depth is predetermined by the angle and amount of cable payed out. Standardized hauls are made by towing at a constant rpm and time. Seventeen fish species have been taken with this gear from two upper White River reservoirs. Major sources of bias are that sampling is limited to open water, no means of closing the net while it is being set or retrieved is provided, and that surface hauls are made in the prop wash directly behind the boat. (Authors)

13979. Davis, William E., and Harold K. Hiltz (International Pacific Salmon Fish. Comm., New Westminster, Brit. Columbia, Canada). 1971. A CONSTANT-FRACTION SAMPLING DEVICE FOR ENUMERATING JUVENILE SALMONIDS. Progr. Fish Cult., 33(3): 180-183.

A device is described for enumerating a downstream migrating fry population by accurately sampling a constant, small fraction of the migration. The device is circular, 4 feet in diameter, with revolving scoops to sample fry in an upwelling flow of 1 to 3 cfs screened from a spawning channel with a flow of 40 cfs. Sockeye (Oncorhynchus nerka) and pink salmon (O. gorbuscha) fry have been enumerated successfully with this sampler and recent tests indicate that the device can be adapted to enumerate seaward migrant sockeye smolts in a small stream where the necessary head is available. (Authors)

13980. Eller, Lafayette L. (Bur. Sport Fish. & Wildl., Fish Pesticide Res. Lab., Columbia, Missouri). 1971. HISTOPATHOLOGIC LESIONS IN CUTTHROAT TROUT (Salmo clarki) EXPOSED CHRONICALLY TO THE INSECTICIDE ENDRIN. Amer. J. Path., 64(2): 321-336, illus.

Pathologic conditions associated with exposure to endrin were found in the gill, liver, pancreas, brain and gonad of cutthroat trout. Edema, hemorrhage and possibly intracapillary congestion characterized gill damage after exposure to the highest level of endrin in bath. Hepatic lesions in young trout were of a type frequently described as preceding the development of hepatomas in nutritionally deficient fish. The increased incidence and severity of hepatic degenerative changes observed in fish exposed to high levels of endrin suggested nutritional deficiency enhanced by exposure to endrin. Marked hyperplasia of pancreatic islets and irregular, atypical oocytes were observed after exposure to high endrin levels. (Auth.)

13981. Wollam, Michael B. (Florida Dept. of Natural Resources Marine Res. Lab., St. Petersburg, Florida). 1970. DESCRIPTION AND DISTRIBUTION OF LARVAE AND EARLY JUVENILES OF KING MACKEREL, Scomberomorus cavalla (Cuvier), AND SPANISH MACKEREL, Scomberomorus maculatus (Mitchill); (PISCES: SCOMBRIDAE); IN THE WESTERN NORTH ATLANTIC. State of Florida Department of Natural Resources Technical Series No. 61, 35 p.

Larvae and juveniles of both king and Spanish mackerel collected by the Florida Department of Natural Resources Marine Research Laboratory are described and figured. Nine additional king mackerel juveniles were loaned by the Bureau of Sport Fisheries' Sandy Hook Marine Laboratory. This report constitutes the first description of the developmental stages of king mackerel and a redescription of some larval stages of Spanish mackerel. Initial identifications are based on the number of vertebral and/or myomere elements with pigmentation patterns and morphometrics providing corroborative evidence. King mackerel have 42 to 43 vertebrae and/or myomeres; larval stages have a large melanophore on the medial surface of the dentary about one third of the distance from the mandibular symphsis; juveniles stages have a saddle-shaped patch of pigmentation on the flank under the second dorsal finlets, and only the anterior five interradial membranes of the first

dorsal fin are pigmented. Spanish mackerel have 52 to 53 vertebrae and/or myomeres; larval stages may have a small chromatophore between the lower jaw rami about one half the distance from the mandibular symphysis; juvenile stages have a lateral band of pigmentation extending the length of the trunk, and all of the interradial membranes of the first dorsal fin are pigmented. A conspicuous spiny projection of the supraoccipital crest present in the larvae of both species is thought to be a generic character. (Auth.)

13982. Houde, Edward D., Charles R. Futch, and Robert Detwyler (Mar. Res. Lab., Fla. Dept. of Natural Resources, St. Petersburg, Florida). 1970. DEVELOPMENT OF THE LINED SOLE, Achirus lineatus, DESCRIBED FROM LABORATORY-REARED AND TAMPA BAY SPECIMENS. State of Florida Dept. of Natural Resources Technical Series No. 62, 43 p.

Morphological development of the lined sole, Achirus lineatus, is described from specimens reared in the laboratory at Miami, Florida, and from plankton collected in Tampa Bay. The pelagic eggs were spherical, averaged 0.74 mm diameter, and had multiple oil globules. Growth of laboratory-reared larvae to 27 days after hatching is described. Larvae grew an average of 0.26 mm per day. Of the initial stock of 300 fertilized eggs, 33 juveniles survived for 30 days after hatching, a survival rate of 0.11. Behavior of larvae in the rearing tank is described. Metamorphosis began in laboratory-reared larvae at 10 days after hatching, when they averaged 3.2 mm SL (standard length). Tampa Bay larvae began to metamorphose at 3.0 mm SL. Metamorphosis was essentially completed at 5.0 mm SL. The sequence of initiation of fin development was: pectorals, dorsal, anal, caudal, and pelvics. Pectoral fins developed on both sides of larvae but disappeared on the left side after metamorphosis. A dorsal tentacle, posterior to the head, developed on larvae, grew to about 50% SL when larvae began to metamorphose, and then gradually disappeared as larvae completed metamorphosis. Four major rows of spinous scales developed on the sides of larvae before they began to metamorphose. Three prominent spinous bony ridges were present on each side of the head, one of which (the right frontal ridge) became the interorbital ridge when the left eye migrated across the dorsal midline. Eye migration was characterized by the left eye moving across the midline under a "hook" formed by the dorsal fin. Body proportions changed during growth and metamorphosis; head length increased and preanal length decreased relative to standard length. The only pigment on embryos and newly hatched larvae was scattered white chromatophores. Distinctive patterns of dark brown, stellate melanophores developed on older larvae. An interbranchial foramen developed in larvae at about 3.0 mm SL. The presence of the foramen and dorsal tentacle serve to separate A. lineatus larvae from the otherwise similar Trinectes maculatus. Larvae of A. lineatus from Tampa Bay usually were more developed at a given length than were laboratory-reared larvae of the same length, and body proportions differed significantly between the two groups. Juveniles from Tampa Bay, Biscayne Bay, and the rearing experiment also differed with respect to certain meristic and morphometric comparisons. Probable reasons for the differences are discussed. (Authors)

13983. Jurie, Fred C., and Frank T. Carlson (Bur. of Comm. Fish. Biol. Lab., Beaufort, North Carolina). 1971. FOOD OF YOUNG ATLANTIC MENHADEN, Brevoortia tyrannus, IN RELATION TO METAMORPHOSIS. U. S. Dept. of Comm., NOAA, NMFS, Fish & Wildl. Serv. Fish. Bull., 68(3): 493-512.

To rear this species in captivity required knowledge of the kinds of organisms it ate. Larvae ate zooplankton (copepods), but prejuveniles and juveniles fed chiefly on phytoplankton. There were similarities as well as differences between the alimentary tract contents of the fish and the composition of the plankton community. Changes in food habits during metamorphosis were accompanied by gross morphological changes in the alimentary tract and related structures. Laboratory studies of larvae disclosed that their failure to feed at low light intensities, their digestion rate, and their defecatory response to capture and preservation probably contributed to the high incidence of empty alimentary tracts in field collections. (Authors)

13984. Dragovich, Alexander (Bur. of Comm. Fish. Tropical Atlantic Biol. Lab., Miami, Florida). 1971. THE FOOD OF SKIPJACK AND YELLOWFIN TUNAS IN THE ATLANTIC OCEAN. U. S. Dept. of Comm., NOAA, NMFS, Fish & Wildl. Serv. Fish. Bull., 68(3): 445-460.

Samples were examined from the stomachs of 1,060 skipjack tuna and 611 yellowfin tuna captured by live bait, longline, trolling, and purse seine in the eastern and western tropical and subtropical Atlantic Ocean in 1965 and 1966. Fish, mollusks, and crustaceans were the principal foods of both species. The major families of fish represented were Scombridae, Carangidae, Serranidae, Balistidae, Gempylidae, and Tetraodontidae; mollusks consisted chiefly of cephalopods (squids); and crustaceans were principally larval macrozooplankton. Frequency of occurrence and displacement volume are given for all taxons of food organisms identified from the stomachs of each species. Fish was the predominant forage volumetrically throughout the Atlantic Ocean and numerically in the western Atlantic; crustaceans were predominant numerically in tunas caught in the eastern Atlantic. In general, crustaceans predominated in the stomachs of the smaller tunas and fish in the stomachs of the larger ones. When the mean percentages of the three principal sources of tuna food - fish, mollusks, and crustaceans - were compared (for tunas caught concurrently), the evidence was that skipjack tuna ate more crustaceans than did yellowfin tuna. Juvenile tunas were eaten by both skipjack and yellowfin tunas. (Auth.)

13985. Merrell, Theodore R., Jr., Melvin D. Collins, and Joseph W. Greenough (Bur. of Comm. Fish. Biol. Lab., Auke Bay, Alaska). 1971. AN ESTIMATE OF MORTALITY OF CHINOOK SALMON IN THE COLUMBIA RIVER NEAR BONNEVILLE DAM DURING THE SUMMER RUN OF 1955. U. S. Dept. of Comm., NOAA, NMFS, Fish & Wildl. Serv. Fish. Bull., 68(3): 461-492.

In 1955 the Oregon Fish Commission estimated the numbers of dead chinook salmon, Oncorhynchus tshawytscha, near Bonneville Dam and studied the probable causes of death. The estimates of numbers of dead fish were made from ratios of tagged to untagged floating carcasses below the dam. Tagged salmon carcasses were released at the dam, and the river below the dam was searched systematically to recover tagged and untagged carcasses. The introduced tagged carcasses and the untagged carcasses of fish that died in the river were assumed to have equal chances of recovery, provided they were not too severely mutilated to be recoverable. This assumption was verified experimentally. On June 30 and July 1, 1955, when riverflows were relatively high, 1,169 tagged chinook salmon carcasses were released at Bonneville Dam. Thirty-one tagged and 117 untagged carcasses were recovered in searches downstream from the release point. On the basis of these recoveries, an estimated 4,412 summer-run chinook salmon died near the dam between June 21 and July 10. On the basis of this estimate, 16.8 percent of the total chinook salmon run died at Bonneville Dam in this period. The numbers of floating carcasses in 1954 and 1955 were directly related to spillway discharge; greatest numbers of floating dead fish coincided with Columbia River flows in excess of 7,100 c.m.s. At Bonneville Dam fall chinook salmon runs have never been subjected to flows above 7,100 c.m.s (killing flows); spring runs are exposed to such flows in some years; and summer runs nearly always encounter such flows. Water temperature, turbidity, disease, and injuries from gill nets did not affect the number of carcasses. Although the specific causes of death and the precise areas at Bonneville Dam where death occurred were not determined in our study, the major source of chinook salmon mortality was associated with the spillway during high flows. Other investigators subsequently demonstrated that during high flows the Columbia River that has plunged over dam spillways is supersaturated with atmospheric nitrogen. This supersaturation may be one of the principal causes of death of fish at mainstem dams. Bonneville Dam is only about 18.3 m. high, and hundreds of thousands of salmon successfully negotiate the fishways each year; yet many salmon are killed during periods of high flow. Complacency about the efficiency of salmon passage over large dams is, therefore, unwarranted, even when elaborate well-designed passage facilities are present and few dead or injured fish are noticed. (Authors)

13986. Asano, Masahiro, and Tamotsu Tanaka. 1971. STUDIES ON THE MATURATION OF THE SKIPJACK IN THE WESTERN PACIFIC OCEAN - I. Bull. Tohoku Fish. Res. Lab., No. 31, pp. 153-161. In Japanese with English abstract.

Histological and histochemical investigations were made on the reproductive cycle of the skipjack. The following division based on histological observation, was used to determine the seasonal gonad development, namely, early perinucleolus stage, late perinucleolus stage, yolk vesicle stage, oil drop stage, primary yolk stage, secondary yolk stage, tertiary yolk stage and migratory nucleus stage. Of particular interest in skipjack vitellogenesis is the formation of the yolk vesicles, which are of very small size and P. A. S. -positive in nature, and asynchronism. According to the histological observation and gonad index, on the other hand, the spawning in the Marianas waters season is usually assumed to be August to September, in Palau and Truk Island waters December to January, and in the western Pacific Ocean August to September and December to January.

13987. Kosaka, Sunao. 1971. ON THE HISTOLOGICAL CHANGE IN THE TESTIS OF THE PRECOCIOUS MASU SALMON PARR (Oncorhynchus masou). Bull. Tohoku Fish. Res. Lab., No. 31, pp. 163-172. In Japanese with English abstract.

Observation was made on histological changes in the testis of the precocious masu salmon parr, Oncorhynchus masou, especially during the maturing and post spawning period. The testes of fry are occupied with germ cells at the spermatogonial stage. In parr, the testes come to be composed of distinct lobules, in which many cysts are recognizable. The cysts contain germ cells of various stages of development from spermatogonia to spermatids. In precociously maturing parr, the cysts full of mature sperm are broken down and the sperms gather in the central lumen of each lobule. In the testis of ripe parr, the wall of the testicular lobules thickens and at the same time the periphery of the lobule disappears, along with the development of the intralobular somatic cells. At this phase spermiation takes place. After spawning, phagocytes appear making a row on the periphery of the lobule. They engulf the residual sperms and enlarge. The testis at the initial phase of the following maturation shows a peculiar structure in the seminiferous tubular type testis. The classification of the testes into two types, lobular and tubular type, is discussed.

13988. Ashley, Laurence M. (Western Fish. Nutrition Lab., Bur. Sport Fish. & Wildl., U. S. Dept. of Interior, Cook, Washington). 1970. PATHOLOGY OF FISH FED AFLATOXINS AND OTHER ANTIMETABOLITES. A Symposium on Diseases of Fishes and Shellfishes, Amer. Fish. Soc. Spec. Publication No. 5, Stanislas F. Snieszko, Editor, pp. 366-379.

Pathological changes occurred in rainbow trout fed seven mammalian carcinogens at various levels. Urethane fed at 320 or 1280 mg/100 g dry diet caused deeply eroded skin ulcers in 30% of fish after 6-8 months. When fed at only 1, 5 or 20 mg/100g dry diet a low incidence of hyperplastic liver nodules and/or microscopic hepatoma nodules occurred. Hepatomagenesis was evident in dimethylnitrosamine (DMN)-fed trout receiving doses of 480 or 1920 mg/100g dry diet; after 12 months all had hepatoma. In addition 1% of fish fed 7, 30, 120, 480 or 1920 mg DMN/100g dry diet for 12-20 months had renal embryoma (nephroblastoma). Low incidences of hepatoma were found in trout fed acetylaminofluorene, aminoazotoluene, para-dimethylaminoazobenzene and DDT. The latter two killed fish when fed at 1920 or 7680 mg/100g and at 120, 480 and 1920 mg/100g dry diet, respectively. Thioacetamide fed at 30 mg/100g dry diet induced lens cataract in 100% of trout after 14 months on test. Aflatoxins were fed to trout, coho salmon and channel catfish as crude or crystalline aflatoxin. Chronic aflatoxicosis induced hepatoma when 20 ppb crude or 0.5-8.0 ppb crystalline B_1 aflatoxin was fed to trout in the daily ration for 3-12 months. Salmon and catfish were refractive to aflatoxin - none had hepatoma after 2 years. Acute aflatoxicosis characterized by hemorrhagic necrosis of liver, hemorrhagic visceral fat and gill edema occurred in trout force-fed crude aflatoxin at 1-5 mg/kg body weight or crystalline aflatoxin B_1 at 0.1-0.5 mg/kg body weight. Most fish died within 3-6 days; survivors were moribund by Day 10. Sham-fed controls remained normal. Coho salmon and channel catfish fed diets containing 320 ppb aflatoxin B_1 for 2 years had histologically

normal livers but when force-fed 10-15 mg B_1/kg body weight acute aflatoxicosis appeared in 21-28 days. Histologically, these livers were similar to those of trout force-fed 0.1-0.5 mg B_1/kg body weight. (Auth.)

13989. Roberts, R. A. (Dept. of Biol. Sci., Univ. of Lancaster, England). 1971. PRELIMINARY OBSERVATIONS ON THE IONIC REGULATION OF THE ARCTIC CHAR Salvelinus alpinus. J. Exp. Biol., 55(1): 213-222.

The degree of euryhalinity in a fresh-water resident population of the arctic char, Salvelinus alpinus, has been determined. Although isolated in fresh water for c. 10000-12000 years these fish still show a high degree of salinity tolerance characteristic of their ancestral stock, but this is variably developed in individuals. In fresh water, blood sodium concentration is regulated at 150 mM/l and chloride at 130 mM/l. These increase to 233 and 218 mM/l respectively in sea water. Fish in sea water show a large increase in muscle sodium, although the potassium concentration is only slightly higher than that maintained in fresh water. The total sodium content of the fish reflects the increase observed in the intracellular and extracellular compartments. The rate of sodium turnover in sea-water-adapted fish is some ten times higher than in fresh-water-adapted fish, although it is significantly lower than that observed in most sea-water-adapted teleosts. (Auth. summ.)

13990. Bane, Gilbert, and Mark Robinson (Southampton College, Long Island Univ., Long Island, New York). 1970. STUDIES ON THE SHINER PERCH, Cymatogaster aggregata Gibbons, IN UPPER NEWPORT BAY, CALIFORNIA. Wasmann J. Biol., 28(2): 259-268.

Life history studies were made on the shiner perch, Cymatogaster aggregata, a common bay fish in southern California. From specimens collected and analyzed over a three year period in Newport Bay and closely adjoining areas, it was found that: C. aggregata is omnivorous, eating mostly small crustaceans and algae; the Newport Bay population is composed mostly of juvenile and one-year old adults; two-year old fish emigrate to the ocean. Juvenile growth is rapid and adult size is reached within one year when growth diminishes. Males are sexually mature at birth, and are distinguished from the females by dark breeding coloration and the presence of a copulatory structure on the anterior portion of the anal fin. Females are sexually responsive soon after birth and breeding occurs during the first summer. In one year old adults, breeding occurs in the spring. Fetal development is in the oviduct and the young are nourished by the ovarian fluid. An average of eight young are born in the spring. After mating, the adults leave Newport Bay and go into the ocean, returning to the shallow water the next spring to give birth. (Authors)

13991. Grant, George C., and Edwin B. Joseph (Virginia Inst. of Mar. Sci., Gloucester Point, Virginia). 1969. COMPARATIVE STRENGTH OF THE 1966 YEAR CLASS OF STRIPED BASS, Roccus saxatilis (Walbaum), IN THREE VIRGINIA RIVERS. Proc. 22nd Ann. Conf. S. E. Assoc. Game and Fish Comm., pp. 501-509.

The age composition, as determined from scale impressions, of striped bass stocks in the James, York, and Rappahannock Rivers during the period June 1967 - March 1968 indicates a relative deficiency of the 1966 year class in the James River. Similar results are shown in samples from non-selective gear (pound nets, fyke nets), selective gear (gill nets, haul seines, hook-and-line), and routine surveys using a 30-foot semi-baloon trawl. The immediate effect of this apparent deficiency on a planned winter tagging program, and the more general implications for evaluation of year-class strength, are briefly discussed. (Authors)

13992. Lachner, Ernest A., and Robert E. Jenkins. 1971. SYSTEMATICS, DISTRIBUTION, AND EVOLUTION OF THE CHUB GENUS Nocomis Girard (PISCES, CYPRINIDAE) OF EASTERN UNITED STATES, WITH DESCRIPTIONS OF NEW SPECIES. Smithsonian Contributions to Zool., No. 85, 97 p. Available from Supt. of Documents, U. S. Government Printing Office, Washington, D. C. 20402, price $1.25 (paper cover).

13993. Grant, George C., Victor G. Burrell, Jr., C. E. Richards, and Edwin B. Joseph (Va. Inst. of Mar. Sci., Gloucester Point, Virginia). 1970. PRELIMINARY RESULTS FROM STRIPED BASS TAGGING IN VIRGINIA, 1968-1969. Proc. of 23rd Ann. Conf. of the S. E. Assoc. of Game and Fish Comm., pp. 558-570.

A total of 8525 striped bass, Morone saxatilis (Walbaum), were tagged and released in Virginia during 1968 and 1969. Releases were grouped in three periods: (1) 3195 in winter 1968, (2) 2439 during summer-fall 1968, and (3) 2891 in winter 1969. Streamer disc tags, employed in winter 1968, were subsequently replaced by internal anchor tags (Floy Tag No. FD-67). This substitution shortened application time and eliminated a source of bias introduced by the entanglement of disc tags in gill nets. Releases were made in the James, York, and Rappahannock rivers in all three periods. Rewards of one dollar have been paid for return of tags. Percentages of returns within tagged year-classes increased with age, indicating change in fishing mortality rates of striped bass during their initial 3 to 4-year residence in the lower Chesapeake Bay system. The older the pre-migrating tagged fish, the more likely its recapture. Proportions of total catch taken by different types of fishing gear are being estimated. Seasonal and annual differences, and differences between neighboring rivers are evident. The recreational share of total catches varied, depending on locale and season, between 10% and 50%. Estimates of annual fishing mortality rates, although preliminary, are included in a discussion of our utilization of tag return data in estimation of population parameters. Inferences on the behavior and migration of stocks are included. (Authors)

13994. Dacre, J. C., and D. Scott (Toxicology Res. Unit, Med. School, Univ. of Otago, Dunedin, New Zealand). 1971. POSSIBLE DDT MORTALITY IN YOUNG RAINBOW TROUT. N. Z. J. of Marine and Freshwater Research, 5(1): 58-65.

An unusually high mortality of eggs and fry of rainbow trout (Salmo gairdneri Richardson) from Lake Taupo in 1966 was possibly caused by excessive exposure to DDT and its metabolites. The egg and fry mortality (44.6%), and DDT level in the fry (4.63 ppm), was compared with other similar cases of possible DDT poisoning in young salmonids, both in New Zealand and North America. Other possible adverse effects on young salmonids exposed to DDT were discussed. (Authors)

13995. Godfriaux, Bruce L. (Mar. Lab., Zool. Dept. Victoria Univ. of Wellington, New Zealand). 1970. FOOD OF PREDATORY DEMERSAL FISH IN HAURAKI GULF. 3: FEEDING RELATIONSHIPS. N. Z. J. of Marine and Freshwater Research, 4(4): 325-336.

In 1965-66, the feeding relationships of snapper Chrysophrys auratus (Forster), trevally Caranx lutescens Richardson, red gurnard Chelidonichthys kumu Lesson and Garnot, horse mackerel Trachurus novaezelandiae Richardson, eagle ray Holorhinus tenuicaudatus (Hector) and john dory Zeus japonicus Cuvier and Valenciennes were examined at two specific sampling areas ("combined" and Kawau stations) in inner Hauraki Gulf and more generally throughout the entire Gulf and along the northwestern edge of the Bay of Plenty. An analysis at specific sampling areas, made by calculating the indices of competitive independence, indicated that interspecific competition occurred rarely and relatively mildly. The general analysis throughout the study region, made by comparing the diet compositions of the predatory fish species, showed that competition was again largely avoided by differences in food preferences and feeding habits. Snapper had the greatest diversity of diet and the smallest feeding overlap; these facts may explain why the relative numbers of snapper are greater than those of any other predatory demersal fish in the region. (Auth. summ.)

13996. Cairns, J., Jr. (Va. Polytechnic Inst., Blacksburg, Virginia). 1971. APPLICATION OF AQUATIC ECOLOGICAL INFORMATION FOR WATER POLLUTION CONTROL IN THE CHEMICAL INDUSTRY. Reprint from Industrial Process Design for Water Pollution Control, Vol. 3, pp. 4-10.

13997. Edwards, Clive A. (Rothamsted Experimental Sta., Harpenden, Herts, England). 1971. PERSISTENT PESTICIDES IN THE ENVIRONMENT. CRC Critical Reviews in Environmental Control, 1(1): 7-67.

The persistence, sources, fate and possible control of pesticides are reviewed and discussed. The amounts of pesticides in soil, air, freshwater, seawater, soil and aquatic invertebrates, plants, fish, birds, other vertebrates, human food and human beings are summarized. The ways the amount of these residues can be decreased are discussed.

13998. De Groot, S. J. (Netherlands Inst. for Fishery Investigations, IJmuiden, The Netherlands). 1971. ON THE INTERRELATIONSHIPS BETWEEN MORPHOLOGY OF THE ALIMENTARY TRACT, FOOD AND FEEDING BEHAVIOUR IN FLATFISHES (PISCES: PLEURONECTIFORMES). Netherlands Journal of Sea Research, 5(2): 121-196.

In flatfish (Pleuronectiformes) the interrelationships between the morphology of the alimentary tract, the food taken, the feeding behaviour and the diurnal activity were studied. For this purpose representatives of the five families of the Pleuronectiformes, viz. Psettodidae, Bothidae, Pleuronectidae, Soleidae, Cynoglossidae, and their sub-families were used. A division was made into three groups, namely (I) fish feeders; (II) crustacean feeders; (III) polychaete-mollusc feeders. This division is based on the shape of the alimentary tract, the relative dimensions of different parts of the alimentary tract (buccal and pharyngeal cavities; esophagus and stomach; intestine; and rectum), absence or presence, and degree of development of the gillrakers on the gillarches, and the type of food taken. Of the three families Bothidae, Pleuronectidae and Soleidae several species occurring in the North Sea were investigated in greater detail to support the above mentioned division. The role of chemical and visual stimuli in feeding was also studied. On this basis it is also possible to distinguish three groups: (1) visual feeders which search food in the daytime and only by sight; (2) visual feeders which find their food in the daytime mainly visually, but also use olfaction; (3) non-visual feeders, which find their food during night mainly by olfactory clues. Further diurnal activity under laboratory conditions was studied, and among others two activity phases could be distinguished: (1) bottom-level activity connected with feeding, occurring in the daytime or during the night depending on the species; and (2) an additional swimming activity off the bottom in higher water levels, confined to the dark period. Stomachs of several species were collected to investigate the diurnal feeding periodicity in still another way. It proved to be necessary to do some experiments on the digestion rate too, in order to clarify the results of the diurnal feeding periodicity. Sea water temperature and the length of the feeding period influence to a great extent the duration of the digestion process. Data on the catch composition of commercial trawlers were analyzed to study the diurnal variation in trawl catches. Data about the relative size of sensory areas in the brain of flatfishes supported the above mentioned results of the experiments on the relation between behavioural type and sensory faculties. Weighing all available evidence around feeding and food, flatfish can be divided into three behavioural groups; (1) the Psettodidae and Bothidae, feeding on fish in the daytime; (2) the Soleidae, feeding on polychaetes and molluscs during the night; and (3) the Cynoglossidae, feeding on crustaceans (during which period is not yet clear). In the Pleuronectidae representatives of fish feeders, crustacean feeders and polychaete-mollusc feeders are found, again forming three behavioural types of Pleuronectidae. (Auth. summ.)

13999. Zamojska, Barbara (Instytut Rybactwa Srodladowego, Zaklad Gospodarki Rybackiej w Rzekach i Zbiornikach Zaporowych, Zabieniec kolo Warsaw, Poland). 1971. THE FOOD COEFFICIENT OF YOUNG PIKE-PERCH FROM LAKE LICHEN. (Wspolczynnik Pokarmowy Mlodego Sandacza z Jeziora Lichen). Polish Agricultural Annual, Seria H - Rybactwo, 93(4): 133-140. In Polish with English synopsis.

The results of investigation of the coefficient of pike-perch aged 0+ in a lake having heated water. During the period from June till September the obtained food coefficient amounted from 2. 8 to 4. 8 at a temperature of water from 23 to 28°C. (Auth. synopsis)

14000. Bartel, Ryszard (Instytut Rybactwa Srodladowego, Terenowa Pracownia Rzeczna, Gdansk-Oliwa, Poland). 1971. KEY FACTORS AFFECTING EGG SIZE IN RAINBOW TROUT (Salmo gairdneri Richardson). [Czynniki decydujace o wielkosci jaj pstraga teczowego (Salmo gairdneri Richardson)]. Polish Agricultural Annual, Seria H - Rybactwo, 93(4): 7-34. In Polish with English synopsis.

The results are given of studies of 877 trout (age 2-8 years, l. c. 20-92 cm, weight 80-12 100 g) from 4 strains. It has been found that the egg size of rainbow trout is not affected by the size of the female, fecundity, condition (in older fish there can appear a weak dependence connected with the emergence of spawners), the age of maturity to spawning or breeding conditions. Some influence on egg size can be exerted by the origin of the fish and by the kind of fodder. The age of spawners possesses, however, decisive importance – egg size increases in females until the 5th or 6th year of life and subsequently decreases. (Auth. synopsis)

14001. Jarzynowa, Barbara (Wyzsza Szkola Rolnicza, Katedra Rybactwa, Lublin, Poland). 1971. THE INFLUENCE OF TAPEWORM Ligula intestinalis (L.) ON THE CHEMICAL COMPOSITION OF THE BODY OF BREAM Abramis brama (Linnaeus). [Wplyw tasiemca Ligula intestinalis (L.) na sklad chemiczny ciala leszcza Abramis brama (Linnaeus)]. Polish Agricultural Annual, Seria H - Rybactwo, 93(4): 35-46. In Polish with English synopsis.

A comparison of the chemical composition of the bodies of bream infected by hookworm Ligula intestinalis (L.) and free from infection by this parasite. The results of investigations of the fat, protein and water content in the meat and viscera of healthy and infected bream. The chemical composition of the body of the parasite. (Auth. synopsis)

14002. Nowak, Wojciech (Instytut Rybactwa Srodladowego, Zaklad Ekonomiki Rybackiej, Olsztyn-Kortowo, Poland). 1971. FISHING EXPLOITATION AND CATCHES OF PIKE IN LAKE DARGIN. (Eksploatacja rybacka i polowy szczupaka w Jeziorze Dargin). Polish Agricultural Annual, Seria H - Rybactwo, 93(4): 87-103. In Polish with English synopsis.

An analysis of the number of pike (Esox lucius L.) in Lake Dargin (3, 030 ha surface) carried out on the basis of catches by means of selected gears in the period 1953-1962. It is found that the pike population underwent condensation during the consecutive years. This is manifested by the increasing catches of pike having a specimen weight exceeding 3 kg and by the fall in fishing outlay needed to catch 1 kg of pike. (Auth. synopsis)

14003. Waluga, Danuta (Wyzsza Szkola Rolnicza, Katedra Ichtiologii, Olsztyn-Kortowo, Poland). 1971. CHANGES IN THE GILLS OF RAINBOW TROUT (Salmo gairdneri Richardson) UNDER THE INFLUENCE OF MALACHITE GREEN. [Zmiany w skrzelach pstraga teczowego (Salmo gairdneri Richardson) pod wplywem zieleni malachitowej]. Polish Agricultural Annual, Seria H - Rybactwo, 93(4): 127-131. In Polish with English synopsis.

Rainbow trout were kept in aquaria filled with malachite green solution having a concentration of 1 : 5, 000, 000. After 10 days the necrosis and losses of respiratory epithelium as well as changes in the vascular vessels of the gills were found to appear. (Auth. synopsis)

14004. Hettler, W. H., Jr., and D. E. Hoss. 1971. A COMPARISON OF TWO FLOWING RESPIROMETERS FOR MEASURING FISH OXYGEN CONSUMPTION. The ASB Bulletin, 18(2): p. 38.

Oxygen consumption of a group of pinfish, Lagodon rhomboides, swimming in a sealed 200 l circular tank was compared to individual respiration by similar fish in small plastic chambers. The salinity, temperature, flow rate, and percent oxygen saturation of the water flowing through each system was controlled. All fish had been maintained undisturbed and without food in the respirometer for 24 hours prior to the oxygen measurements. Oxygen concentrations were measured polarographically. The oxygen consumed by a group of 128 pinfish (mean weight 7.7 g) was 0.125 mg/g/hr at 29.2 p.p.t. salinity and 14.9 C. Ten pinfish (mean weight 7.5 g), measured individually, respired at an average rate of 0.160 mg/g/hr

at 30.8 p.p.t. salinity and 14.5 C. The results suggest that the normal metabolic rate may be nearly the same as the routine metabolic rate for this species and not twice the rate as reported by others. (Authors)

14005. Vaas, K. F. (Delta Inst. for Hydrobiol. Res., Yerseke, The Netherlands). 1970. STUDIES ON THE FISH FAUNA OF THE NEWLY CREATED LAKE NEAR VEERE, WITH SPECIAL EMPHASIS ON THE PLAICE (Pleuronectes platessa). Netherlands Journal of Sea Research, 5(1): 50-95.

After a brief description of the way a new lake was created near Veere in 1961 by the construction of two dams in a side-arm of the Oosterschelde, the changes in the fish fauna are described. As a result of the abrupt disruption of the contact with the coastal sea water, many species formerly temporary residents of the open sea-arm, proved to stay away. The chlorinity of the lake dropped from 16 to 17 ‰ Cl' to a fluctuating value of about 6.5 to 12.5 ‰ Cl', owing to the annual flushing with saline water from the Oosterschelde. A strong eutrophication set in, mainly caused by run-off from neighbouring land under agriculture. Species, able to reproduce within the lake: Zoarces viviparus, Gobius minutus, and G. microps increased in numbers, but after some years the eel, entering via the locks in the dam from the Oosterschelde, was the most numerous. Immediately after the closure the plaice was the principal species, consisting of 0 and 1 year old individuals, with a few older ones, as is the case in the Oosterschelde where the plaice enter in their first season from the spawning places in the Southern Bight of the North Sea. As the immigration is rather small the numbers of plaice decreased rapidly in later years, the more so as no reproduction could take place in this unusual environment. Plaice from the lake are heavier than those from the sea of similar length and the percentage of dry matter in the flesh is higher. They were found to be mature earlier and to produce more eggs. The gut contents were examined and a paucity of siphons of large bivalves, the preferred kind of food in the sea, was observed. With the aid of the Winberg-formulae the energy budget for the year 1964 of the part of the population living permanently in the deeper parts in the centre of the lake, could be ascertained, because in March of that year an estimation of the magnitude of the population was made by means of arrow-tags. As the monthly losses to the fishery were known, the strength of the population in January could be calculated, and also the numbers of immigrants, because the age-structure of the population was ascertained every month. The ratio between the increase of the permanent stock and the amount of food consumed, calculated on a caloric base, proved to be 4.81. (From auth. summ.)

14006. Wolf, Ken, and M. C. Quimby (U. S. Dept. Interior, Bur. Sport Fish. & Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia). 1971. SALMONID VIRUSES: INFECTIOUS PANCREATIC NECROSIS VIRUS. Archiv fur die gesamte Virusforschung, No. 34, pp. 144-156.

Epizootics occurred among young trout in France, and the behavior and symptoms suggested infectious pancreatic necrosis (IPN) virus. Specimens preserved in glycerol were sent to the U.S.A. for virological examination. Virus was isolated from four of five lots, but neutralization with antiserum against ATCC VR299 strain IPN virus was incomplete. Electron microscopy, bioassay, histopathology, and serology were used to identify the viruses. The results showed the agents to be new strains of IPN virus with distinctive antigenicity and heretofore unknown lability at 4°C and marked vulnerability to a single freezing and thawing. A method of improving stability in storage was found. Electronmicrographs, tabular and graphic data are presented. (Authors summ.)

14007. Shishkova, E. V., A. S. Nikolaev, and I. I. Sizov. 1971. NOISES OF PACIFIC OCEAN SALMONS. (Shumy tikhookeanskikh lososeĭ). Rybnoe Khozyaĭstvo, No. 2, pp. 12-15. In Russian.

Investigations revealed the prespawning noises of Pacific Ocean salmons, given off with the help of the swimbladder. The noises bear a regular character and in the future can be utilized for reconnaissance of the salmon by sound direction-finding. In view of the considerable surpassing of the level of the fish signals over

the noises of the sea, it will be possible to accomplish sound direction-finding of pre-spawning aggregations of salmon from distances of several kilometers. -- Robert M. Howland

14008. Metcalf, Robert L., Gurcharan K. Sangha, and Inder P. Kapoor (Depts. of Zool. and Entom., Univ. of Ill., Urbana-Champaign, Illinois). 1971. MODEL ECOSYSTEM FOR THE EVALUATION OF PESTICIDE BIODEGRADABILITY AND ECOLOGICAL MAGNIFICATION. Environmental Science & Technology, 5(8): 709-713.

A small laboratory "model ecosystem" has been developed to study the biodegradability of pesticides, and evaluated with radiolabeled DDT, DDE, DDD, and methoxychlor. The model ecosystem has a terrestrial-aquatic interface and a seven-element food chain. It simulates the application of pesticides to crop plants and the eventual contamination of the aquatic environment. When used with 5 mg of ^{14}C-labeled DDT applied at an equivalent rate of about 1 lb per acre, the radiolabeled DDT was accumulated in mosquito larvae, snails, and fish as DDE, DDD, and DDT and concentrated from 10,000- to 100,000-fold. ^{14}C-DDE was concentrated 30,000- to 50,000-fold and stored with little metabolism, while ^{3}H methoxychlor was readily metabolized to mono- and di-OH derivatives and was stored at comparatively low levels. The model ecosystem approach has considerable value for studying the biodegradability and ecological fate not only of new candidate pesticides, but also of industrial chemicals. (Authors)

14009. Apostolski, K. (Fish. Inst., Skopje, Yugoslavia). 1971. ACCLIMATIZATION OF THE ISRAELI CARP IN LAKE DOJRAN, (MACEDONIA), YUGOSLAVIA. Bamidgeh, 23(1): 3-10.

During the years 1958-1962, the carp yield of Lake Dojran showed a continual decline. To raise the carp yield and vary the fish population, it was decided in 1961 to initiate planned stocking of the lake. For this purpose, spawning and nursery ponds were constructed near the lake. In the first years, the local carp was stocked in the lake, but gave disappointing results. After consultation with various institutes and the Fish Diseases Laboratory at Nir-David (Israel), twelve one-year-old breeder carps were brought from Israel in 1964. Since 1965 the lake has been successfully stocked with the Israeli carp. Systematic observations were instituted only after November 1968. The average annual weight increment of the Israeli carp was over 1,000 g, and in isolated cases up to 3,000 g. In addition, the Israeli carp is distinguished by more precocious sexual maturity. In Macedonia, the Israeli carp matures in the first year, indicating its high adaptability. In addition, the carp reproduces wild in Lake Dojran. The Israeli carp has 7% more flesh than the local carp, and thus has higher market value. These excellent qualities of the Israeli carp were expressed in all the water bodies in which it was grown. It is recommended that more intensive observations be made in the near future to ascertain these excellent qualities, and to establish its identity as a separate variety valuable for stocking fishponds. (From auth. summ.)

14010. Hepher, B., J. Chervinski, and H. Tagari (Fish Culture Res. Sta., Dor, Israel). 1971. STUDIES ON CARP NUTRITION III. EXPERIMENTS ON THE EFFECT ON FISH YIELD OF DIETARY PROTEIN SOURCE AND CONCENTRATION. Bamidgeh, 23(1): 11-37.

Protein-rich diets affect carp growth in ponds only when a protein deficit with respect to fish requirement is created. Diets containing fish meal had a better effect on fish growth than those containing soybean meal; those containing 22% fish meal were better than those containing lesser amounts. Although causing a decrease in weight gain per fish, increasing the stocking rate increased the yield per hectare. Increasing the sorghum ration per fish in densely populated stocked ponds resulted in an appreciable increase in growth rate and yield per hectare. This was due mainly to accumulation of body fat. Increasing wheat rations fed to the fish in densely stocked ponds did not result in increased growth. Increasing the rations of protein-rich diets in a densely stocked pond resulted in a further increase in yields. However, the utilization of the proteins in these conditions was low. Further studies on the growth factors lacking in the feed may result in increased growth of fish and a better utilization of feed. (From authors conclusions)

14011. Cooper, Edwin L., Charles C. Wagner, and George E. Krantz (Pa. State Univ., University Park, Pennsylvania). 1971. BLUEGILLS DOMINATE PRODUCTION IN A MIXED POPULATION OF FISHES. Ecology, 52(2): 280-290.

The effects of exploitation on growth, condition, and surplus production were measured over an 8-year period for a population of seven species of warm-water fishes in a 4.05-ha lake. The lake was shallow, fertile, and moderately productive. Population estimates of individual species were made each spring concurrently with the annual removal of 34% to 71% of the existing population. The initial stock density of all species was 48.66 g/m^2 in the spring of 1962. The optimum yield for this mixed population was calculated to be 14.56 g/m^2 per year at a stock density of 18.67 g/m^2, with the bluegill producing most of this surplus weight. When species were considered separately, there was poor correlation between exploitation rate and either growth or condition. The response of the entire population to thinning was more predictable, with both growth and condition related to stock density. Best growth occurred at densities near 20 g/m^2 or approximately at the level for optimum yield. (Authors)

14012. Raleigh, Robert F. (Bur. of Comm. Fish., Biol. Lab., Seattle, Washington). 1971. INNATE CONTROL OF MIGRATIONS OF SALMON AND TROUT FRY FROM NATAL GRAVELS TO REARING AREAS. Ecology, 52(2): 291-297.

The upstream and downstream directional responses of demes of sockeye salmon (Oncorhynchus nerka) fry from inlet and outlet streams hatched and reared under controlled, identical conditions were tested in the laboratory. The tests compared innate directional responses of fry from the two sources to variables of water source and temperature. Both variables influenced the directional responses of the fry. The direction of migration (upstream for outlet fry or downstream for inlet fry) and response to changes in the test variables differed substantially between fry from inlet or outlet streams; this response difference held for populations of sockeye salmon from different geographical locations (Canada and Alaska). The differences were concluded to be innate in origin. Single tests of fry of rainbow (Salmo gairdneri) and cutthroat (S. clarki) trout from inlet and outlet streams indicated that directional responses of fry from these species are also innately influenced. The significance of matching the innate responses of donor stocks of fish to the characteristics of a recipient environment is discussed. (Auth.)

14013. Perkins, Richard J., and Michael D. Dahlberg (Univ. of Georgia, Marine Inst., Sapelo Island, Georgia). 1971. FAT CYCLES AND CONDITION FACTORS OF ALTAMAHA RIVER SHADS. Ecology, 52(2): 359-362.

The fat content and "condition factor" of American shad (Alosa sapidissima) and hickory shad (A. mediocris) in the Altamaha River drainage in Georgia are analyzed. The fat content of these anadromous species ranged from 5.1 to 17.8% for American shad and from 3.0 to 12.9% for hickory shad. In contrast to Pacific salmon (Oncorhynchus), fat content did not decrease with distance upstream, probably because of the relatively short and easy passage. The likely decrease in fat content with spawning was not statistically demonstrable because of the small number of spent individuals analyzed. Condition factor was not consistently related to fat content. (Authors)

14014. Bell, Henry L. (U. S. Dept. of Interior, Fed. Wat. Poll. Control Admn., National Water Quality Lab., Duluth, Minnesota). 1971. EFFECT OF LOW pH ON THE SURVIVAL AND EMERGENCE OF AQUATIC INSECTS. Water Research, 5(6): 313-319.

Mature larvae and nymphs of 9 species of aquatic insects (dragonflies, stoneflies, caddisflies, and mayfly) were tested in the laboratory at pH values from 1.0 to 7.0. The TL_{50} values (pH at which 50 percent of the organisms died) at 30 days ranged from pH 2.45 (Brachycentrus americanus) to pH 5.38 (Ephemerella subvaria). The range at which 50 percent of the insects emerged was pH 4.0-5.9. The 9 species tested were all more sensitive to low pH during the period of emergence. (Auth.)

14015. Sprague, J. B. (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1971. REVIEW PAPER: MEASUREMENT OF POLLUTANT TOXICITY TO FISH - III. SUBLETHAL EFFECTS AND "SAFE" CONCENTRATIONS. Water Research, 5(6): 245-266.

If the modes of action of toxicants were better understood, we could more accurately predict their effects as pollutants; much knowledge already exists in medical sciences, and could be transferred. Sublethal changes within fish have been demonstrated by many sensitive histopathological and biochemical techniques. Unfortunately, ecological significance often remains obscure for these effects and others mentioned below. Growth should be routinely measured in all chronic experiments since it is easy, but it is not always a sensitive indicator of toxicity. Swimming speed is less often affected by toxicants than might be expected; clear-cut effects are usually related to impaired respiration. A toxicant might be assessed by testing whether it reduced the fish's scope for activity (active minus standard oxygen uptake). Behavioural change is often a very sensitive response, although significance in nature may be uncertain. Feeding behaviour of fish is badly affected by some pollutants. Avoidance reactions to many pollutants have been demonstrated in the laboratory, but no pattern for predicting avoidance in nature is yet available. Effects on other aspects of behaviour such as social interactions should be explored. Reproduction seems to be one of the most sensitive of chronic or sublethal responses which is clearly meaningful in nature. Reproductive success should be tested whenever feasible. It is sometimes sharply affected through inhibition of spawning or through toxicity to fish fry. Perfect bioassays are studies of production in communities of artificial or experimental streams, being equivalent to small controlled ecological experiments. Such studies are especially meaningful if they cover one or more reproductive cycles. Laboratory bioassays are inadequate if they do not explain the results of field bioassays in polluted waters. The ultimate method of bioassay is an ecological survey of a polluted habitat. Current estimates of "safe" levels of pollutants for fish are mostly 0.01-0.4 of the lethal concentration. The higher values of 0.1-0.4 are obtained from distribution of fishes in polluted rivers, and from extrapolations from lethal levels to negligible mortality. Lower values of 0.01-0.05 arise mostly from consideration of chronic, sublethal, and cumulative toxicity. There is a continuing need for critical reviews on individual pollutants. (Auth.)

14016. Kemp, P. H. (Natal Reg. Lab., National Inst. for Water Research (S.A. Council for Scientific and Industrial Research), Durban, South Africa). 1971. CHEMISTRY OF NATURAL WATERS - I. FUNDAMENTAL RELATIONSHIPS. Water Research, 5(6): 297-311.

The ideal fundamental equations governing the interionic equilibria existing in natural waters are presented, using the systematic approach devised by Ricci. The advantage of this particular approach is that it leads automatically to simple approximations of very high accuracy which are applicable under conditions that can be precisely specified. It is in general unnecessary to adduce additional and dubious simplifying assumptions that might vitiate the final results. The equations are readily corrected for non-ideality by considering the total dissolved solids content of the water. They lead to relatively simple expressions for the hydrogen ion concentration and hence the pH value of such waters. (Auth.)

14017. O'Hara, James (Biol. Dept. Antioch Coll., Yellow Springs, Ohio). 1971. ALTERATIONS IN OXYGEN CONSUMPTION BY BLUEGILLS EXPOSED TO SUBLETHAL TREATMENT WITH COPPER. Water Research, 5(6): 321-327.

Oxygen consumption rates were determined for juvenile bluegills subjected to various concentrations of copper. Respiratory response were strongly correlated with copper concentrations up to the 96-h TL_m value of 2.4 mg l^{-1} of copper. Higher concentrations produced greater responses although the results were more erratic. The concentration that caused no alteration in the rate of oxygen consumption was found to be 0.1 mg l^{-1} of copper. It is suggested that this measure provides a fast and sensitive tool to help establish water quality criteria. (Auth.)

14018. Benson, Norman G. (Editor). 1970. A CENTURY OF FISHERIES IN NORTH AMERICA. Spec. Publication No. 7, Amer. Fish. Soc., Washington, D. C., 330 p. $10.; Trans. Amer. Fish. Soc., 100(3): 592-593, Henry A. Regier (reviewer), 1971; Comm. Fish. Abstr., 24(10): p. 5, 1971.

For this book, 20 authors have written chapters synopsizing the history of the American Fisheries Society from 1870 to 1920 and from 1920 to 1970; describing trends in research, education, and fish culture; dealing with fresh-water fisheries--southeastern pond culture, the Great Lakes, northern glacial lakes, western mountain lakes, central warm-water streams, northeastern trout streams, and central and southwestern reservoirs; reviewing the marine fisheries--those for Pacific sardine, herring, Pacific halibut, Pacific salmon, Pacific tuna, Atlantic groundfish, and shellfish; reporting on the status of the society at its centennial; and looking at the future of sport fisheries management. The book has 12 appendices. (The reviewer concludes, just from the weight of evidence, that "North America" as it is used in this book actually means "United States.")

14019. Parker, Jack Clark (Agric. Ext. Serv., Texas A&M Univ., College Station, Texas). 1971. THE BIOLOGY OF THE SPOT, Leiostomus xanthurus Lacepede, AND ATLANTIC CROAKER, Micropogon undulatus (Linnaeus), IN TWO GULF OF MEXICO NURSERY AREAS. Sea Grant Publication No. TAMU-SG-71-210, 182 p.; Comm. Fish. Abstr., 24(10): p. 6.

The distribution of spot and Atlantic Croaker in the vicinity of Lake Borgne, Louisiana and Galveston Bay, Texas was determined in relation to temperature, salinity, and certain hydrographic features. Geographic variations in spawning, growth rates, distribution and food habits were evaluated. Length-weight relationships were compared between the two areas, and in Galveston Bay, condition of fish was studied in relation to size of fish, habitat, season, temperature, and salinity. (From auth.)

14020. Newsome, William H. (Res. Labs, Food and Drug Directorate, Dept. of National Health and Welfare, Ottawa, Canada). 1971. DETERMINATION OF METHYLMERCURY IN FISH AND IN CEREAL GRAIN PRODUCTS. J. Agric. Fd Chem., 19(3): 567-569; Comm. Fish. Abstr., 24(10): p. 15.

Current methods for the determination of methylmercury in fish involves the acidification of an aqueous homogenate of the tissue followed by extraction with benzene. In subsequent steps an emulsion formed, probably due to presence of lipoprotein materials, rendering the method unsatisfactory. The author eliminated this problem by modifying the existing methods for fish by incorporating a filtration step and by the use of hydrobromic acid rather than hydrochloric acid to enhance the partition ratio and facilitate the extraction of methylmercury from the aqueous phase. The centrifugation step to separate the benzene and homogenate was eliminated. The recovery of methylmercury in whitefish was 94% $\pm$ 6%, and in cod it was 98% $\pm$ 6%.

14021. Payne, R. H., A. R. Child, and A. Forrest (Ministry of Agric., Fish., and Food, Salmon and Freshwater Fisheries Lab., Weymouth, Dorset, England). 1971. GEOGRAPHICAL VARIATION IN THE ATLANTIC SALMON. Nature, 231(5300): 250-252; Comm. Fish. Abstr., 24(10): p. 20.

This article presents information on the analysis by starch gel electrophoresis of the serum transferrin phenotypes of 4,492 Atlantic salmon collected during the summers of 1969 and 1970 at several locations in Britain, Ireland, and the Gulf of Saint Lawrence (Canada). The paper further reports the discovery of a serum protein polymorphism in the Atlantic salmon that reveals the existence of genetically isolated populations sufficiently distinct to merit their separation into subspecies and races.

14022. FAO of the United Nations (Rome, Italy). 1971. MANUAL OF METHODS FOR FISHERIES RESOURCE SURVEY AND APPRAISAL. PART 1. SURVEY AND CHARTING OF FISHERIES RESOURCES. FAO Fisheries Technical Paper No. 102, 80 p., edited by D. L. Alverson (NMFS, NOAA, Seattle, Washington).

14023. Douglas, Philip A., and Richard H. Stroud (Sport Fishing Inst., 719 13th St., N. W., Suite 503, Washington, D. C.) (Editors). 1971. A SYMPOSIUM ON THE BIOLOGICAL SIGNIFICANCE OF ESTUARIES. Published by Sport Fishing Inst., 111 p.; Comm. Fish. Abstr., 24(10): p. 19.

Well over half the marine fisheries resources of the Continental Shelf that abuts the U. S. land mass are fully dependent on estuaries as spawning or nursery grounds. Yet this national heritage is being rapidly destroyed for short-term economic gain, both private and municipal. The purpose of this public-oriented symposium (held in Houston, Tex., on February 13, 1970) was to lay the foundation for a symposium to be held the following day in which socio-political aspects of uses of estuaries would be discussed. (The follow-up symposium was conducted by representatives of the Sportsmen's Clubs of Texas and the National Wildlife Federation.) Both symposia were designed to bring to the lay public, particularly to leadership elements, a comprehensive view of why the estuaries of the United States are important and what American citizens can do to foster their maintenance for a multiplicity of uses--in perpetuity. The sponsors of the symposia expressed the hope that improved communications among aquatic scientists, economists, engineers, sociologists, politicians, planners, and the general lay public would help create an improved climate for solving the problems associated with maintaining the estuarine environment in a productive condition. Among the papers presented were the following: "The Biology of the Estuary," by L. Eugene Cronin and Alice J. Mansueti (Chesapeake Biological Laboratory, Natural Resources Institute, University of Maryland, Solomons, Md. 20688); pp. 14-39.

14024. Reichenbach-Klinke, H. H. 1970. THE ECONOMIC IMPORTANCE OF FISH DISEASES. (Die wirtschaftliche Bedeutung der Fischkrankheiten). Tierarztliche Wochenschrift, 83. Jahrgang, Heft 24, S. 491-493.

Economic losses caused by diseases and fish kills in Western Germany are estimated to be $14,000,000 per year. It is expected that with the changes from pond culture to the intensive tank culture fish production may increase several times and disease control will be even more important. For these reasons additional laws will be needed to prevent introduction and transmission of communicable fish diseases. Training of veterinarians in fish diseases and background biological disciplines is urgently needed. In the Soviet Union there are 120 veterinary laboratories with 250 veterinary fish pathologists engaged in various aspects of fish health and fish culture. New fish cultural facilities can only be established in U. S. S. R. if a prospective fish farm meets the eleven basic requirements. It is believed that in Western Germany there is a need for veterinarians trained in all aspects of fish diseases and their control. It is recommended that veterinary schools establish teaching and research facilities in their discipline. It is expected that improvement of fish culture and fish disease control will pay for itself. There is apparently a new disease of grayling in Western Germany. Symptoms are similar to those of furunculosis but a virus is suspected as the cause. -- S. F. Snieszko

14025. Fink, Bernard D., and William H. Bayliff (Inter-Oceanic Factors, Inc., Long Beach, California). 1970. MIGRATIONS OF YELLOWFIN AND SKIPJACK TUNA IN THE EASTERN PACIFIC OCEAN AS DETERMINED BY TAGGING EXPERIMENTS, 1952-1964. Inter-American Tropical Tuna Comm., Bull. 15(1): 1-228.

Totals of 59,547 tagged yellowfin and 90,412 tagged skipjack were released during 1952-1964 throughout the range of the fishery in the eastern Pacific Ocean during that period. Most of the fish were released from commercial baitboats, either on regular fishing trips or on chartered trips to catch fish for tagging. There were 8,397 yellowfin and 4,381 skipjack returned from these releases. There appear to be two main groups of yellowfin in the eastern Pacific Ocean. There is considerable intermingling among the fish of the two groups, however. The fish of the northern group (west coast of Baja California, Gulf of California, and Revillagigedo Islands) first appear in the Revillagigedo Islands in about April, and migrate north along the Baja California coast during the spring and summer and south along that coast during the fall. Recruits to the southern group (Tres Marias Islands to northern Chile) appear at many points or continuously along most of the coast. The

fish which first appear in the northern Panama Bight in April migrate rapidly northwest to Central America and Mexico and south to the Gulf of Guayaquil. There also appear to be two main groups of skipjack in the eastern Pacific Ocean. The fish of the northern group (west coast of Baja California, Gulf of California, and Revillagigedo Islands) perform about the same migration as do the yellowfin of the same area, but most of the skipjack apparently then migrate to the central Pacific Ocean during the fall and/or winter. Recruits to the southern group (Central America to northern Chile) appear mostly in or near the Panama Bight. The fish which first appear in the northern Panama Bight in April migrate rapidly northwest to Central America and south to the Gulf of Guayaquil. The proportions which migrate in these directions vary considerably from year to year, this perhaps being dependent on differences in the sea-surface temperatures. (Authors)

14026. Williams, F. (Inst. of Marine Resources, Scripps Inst. of Oceanography, Univ. of Calif. at San Diego, California). 1970. SEA SURFACE TEMPERATURE AND THE DISTRIBUTION AND APPARENT ABUNDANCE OF SKIPJACK (Katsuwonus pelamis) IN THE EASTERN PACIFIC OCEAN, 1951-1968. Inter-American Tropical Tuna Comm., Bull. 15(2): 229-281.

Isograms of sea surface temperature (°C) have been produced for 1949-1968 for the areas of the eastern Pacific Ocean in which the majority of the skipjack catch is taken. These are in the immediate coastal zone, California (35° N) to Chile (20° S), and the Revillagigedo and Galapagos Islands groups. Skipjack occurrence and apparent abundance (as CSDF, i.e., catch per standard days fishing, standardized in purse-seiner units) for 1951-1968 were then superimposed on the surface temperature isograms. Results show that skipjack occur at surface temperatures $>$ 17° C but with the majority between 20°-30° C. Apparent abundance at CSDF $>$ 1 ton/day is normally limited to 20°-29° C water, except in two areas in certain years; from the Gulf of Tehuantepec to Cape Mala rates of 1-9 tons/day are relatively common at 29°-30° C, and off Chimbote (Peru) occasionally $>$ 9 tons/day are recorded down to 18° C. As expected there were no apparent relationships between annual thermal conditions in the coastal zone and skipjack abundance (total catch or indices of abundance) in the same or 2 subsequent years. An appendix to the report determines the quantitative relationships between surface temperature and skipjack abundance in relatively small areal strata in Baja California waters in 1955 and 1958. Relationships generally appeared significant and opposite in these years when temperatures were respectively anomalously cold and warm. (Auth.)

14027. Lee, P. J. 1971. THE PRINCIPLE AND OPERATION OF FISH CATCH AND POLLUTION INFORMATION SYSTEM. Fish. Res. Bd. Canada Tech. Rep. No. 250, 105 p.

There has been increasing recognition of the fact that electronic data processing on a general fish catch system enables fisheries biologists to utilize the large resource of data currently and potentially available to them. This report reviewed the existing status of the utilization of fish catch data in order to set the general fish catch record system. The fish catch system described was derived from field data recording formats of Goldsand Lake, Lake Superior, and Heming Lake. The pollution information system was added to the system in December 1970. This system allows us to process pollution information alone or together with fish catch information. (From auth. introduction)

14028. Fletcher, G. L., R. J. Hoyle, and D. A. Horne. 1971. THE RELATIVE TOXICITIES OF YELLOW PHOSPHORUS PRODUCTION WASTES TO SEAWATER-MAINTAINED FISH. Fish. Res. Bd. Canada Tech. Rep. No. 255, 14 p. + 4 figs.

This report outlines some of the investigations conducted to evaluate the relative fish toxicities of fluosilicic acid, cyanide, sulfite, ammonium chloride, sodium sulfide, and yellow phosphorus which occurred, or may have occurred, in the main effluent of the elemental phosphorus plant situated at Long Harbour, Newfoundland. Brook trout, smelt, mummichogs, cunners and herring were utilized in the bioassays.

14029. Kerr, S. R. (Fish. Res. Bd. Canada, Marine Ecology Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1971. ANALYSIS OF LABORATORY EXPERIMENTS ON GROWTH EFFICIENCY OF FISHES. J. Fish. Res. Bd. Canada, 28(6): 801-808.

Paloheimo and Dickie (J. Fish. Res. Bd. Canada 23: 869-908, 1966) described a regular variation between growth efficiency and ration level of fishes, termed a "K-line." Subsequent work has either confirmed the phenomenon, or suggested that it is a special case observable only at high ration levels. Two recent published experiments are reanalyzed with the aid of an analytic model based upon the metabolic requirements of fishes. The reality of the K-line is confirmed, and it is concluded that it occurs because metabolic expenditure upon spontaneous activity increases more than proportionately to increased rations, increasing the fraction of ration energy dissipated as metabolism, and thereby decreasing growth efficiency. (Auth.)

14030. Kerr, S. R. (Fish. Res. Bd. Canada, Marine Ecology Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1971. PREDICTION OF FISH GROWTH EFFICIENCY IN NATURE. J. Fish. Res. Bd. Canada, 28(6): 809-814.

Using an equation system based upon the requirements of searching for prey, and the physiological properties of the predator, the hypothesis that growth efficiency of pelagic predators may be importantly determined by the metabolic cost of searching for prey is examined. The equation system indicates that growth efficiency decreases when the prey organisms become either rare or small in relation to the size of the predator. The system also indicates that sustained growth requires increasingly large prey organisms even if these are increasingly rare. Review of empirical literature indicates that the system's predictions are in accord with observation. (Auth.)

14031. Kerr, S. R. (Fish. Res. Bd. Canada, Marine Ecology Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1971. A SIMULATION MODEL OF LAKE TROUT GROWTH. J. Fish. Res. Bd. Canada, 28(6): 815-819.

Kerr (J. Fish. Res. Bd. Canada 28: 809-814, 1971) described an equation system based upon metabolic constraints and foraging limitations that predicts level of rations and growth efficiency as a function of the availability of the prey resource. An algorithm that extends the equation system to a growth model is described here. With reference to increasing predator size, and to the mean size and abundance of prey, the model computes successive growth increments while holding the equations to the configuration that maximizes the ratio of growth efficiency to rations. When given information on the mean size and density of prey organisms, the model accurately predicts observed patterns of lake trout growth. (Auth.)

14032. Todd, Ian St. P., and P. A. Larkin (Dept. of Fisheries and Forestry, Vancouver, Brit. Columbia, Canada). 1971. GILLNET SELECTIVITY ON SOCKEYE (Oncorhynchus nerka) AND PINK SALMON (O. gorbuscha) OF THE SKEENA RIVER SYSTEM, BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 28(6): 821-842.

Exploitation of Skeena River sockeye salmon has been conducted almost solely by drift gillnets since 1875. This study was designed to determine the selective properties of nylon gillnets presently in use; to compare these with properties of linen nets used prior to 1955; and, using statistics of catch and escapement, to estimate the selective action of the fishery as a whole on sockeye and pink salmon in 1968. Unique selectivity curves for nylon nets of 4-5/8 – 5-5/8-inch mesh size could not be determined from sockeye catches. Mean size of age class 1.2 sockeye increased with mesh size but mean size of the predominant age class 1.3 sockeye demonstrated no trend. Age class 1.3 sockeye were among the largest on record and were too large to gill properly in all mesh sizes used. Comparison of 5-1/4-inch mesh nylon gillnet with linen nets of 5-5/8-inch mesh used in the historic fishery was also influenced by the large size of age class 1.3 sockeye. Nylon nets were 2.5 and 2.7 times as efficient as linen for sockeye, and 8.0 and 9.0 times

for pink salmon. Nylon gillnets caught larger sockeye and pink salmon than did linen. Variances of mean size were also greater for catches in nylon. The statistics of catch and escapement for 1968 indicated that selection increased over the length range of age 1.2 sockeye but decreased over the length range of age class 1.3 sockeye. For pink salmon, which were extremely small in 1968, selection was increasingly large for larger size males and females. The length-girth relations of the species and sexes accounted for most of the difference between the selectivity curves. Retention by gillnets declined once the girth/mesh ratio exceeded 1.2 for sockeye. For pink salmon, no females were of a size to equal this ratio; the descending limb of the selectivity curve was due solely to males as the retention rates declined once girth/mesh ratio exceeded 1.0. These findings suggest that in most years the gillnet fishery on the Skeena River would tend to select relatively larger sockeye salmon. In years such as 1968, however, selection would be against smaller fish. This frequent reversal combined with the intense modern fishery, which tends to remove virtually all fish during a short period and allows almost complete escapement in periods between fishing, suggests that selective fishing has probably not been a significant factor in decreased production. (Authors)

14033. Mundie, J. H. (Fish. Res. Bd. Canada, Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1971. SAMPLING BENTHOS AND SUBSTRATE MATERIALS, DOWN TO 50 MICRONS IN SIZE, IN SHALLOW STREAMS. J. Fish. Res. Bd. Canada, 28(6): 849-860.

Stream bed materials, both biotic and abiotic, in the size range 50 μ-ca. 200 mm can be sampled unselectively, in shallow streams, with a simple inexpensive apparatus consisting of a box provided with an adjustable upstream inlet, and, downstream, two nets, one within the other. Collected materials are wet-sieved and the volumes of inorganic material passed by successively finer sieves are plotted as cumulative curves against a logarithmic size scale. Curves are given for materials from three contrasting habitats: a riffle, and pool, of a coastal stream, and an artificial spawning channel. Examples are also given of the densities, size distribution, and vertical stratification of invertebrates from these habitats. Applications of the method to studies on fish biology, invertebrate ecology, and geomorphology are indicated. (Auth.)

14034. Bilton, H. T., and G. L. Robins (Fish. Res. Bd. Canada, Biol. Lab., Nanaimo, Brit. Columbia, Canada). 1971. EFFECTS OF FEEDING LEVEL ON CIRCULUS FORMATION ON SCALES OF YOUNG SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 28(6): 861-868.

Feeding level exerted a significant influence on scale growth of young sockeye salmon (Oncorhynchus nerka) maintained for 2 months at a temperature of 13.98 ± 0.29 C and a constant photoperiod of 12 hr light and dark. The number and spacing of circuli, scale radius, and length and weight of the fish were all correlated with the feeding level. Two checks at most were observed on scales of fish in the experimental populations. At midpoint of the experiment, incidence of a first check was highest among fish that had been held at a high feeding level. At the end of the experiment a second check was apparent only on scales of fish that had the feeding levels raised at midpoint of the experiment. There were significant correlations between the nucleus radius of the scale and length and weight of the fish. (Authors)

14035. Vestergård Jørgensen, P. E. (State Vet. Serum Lab., Dept. for Jutland, Hangovej 2, 8200 Aarhus N, Denmark). 1971. EGTVED VIRUS: DEMONSTRATION OF NEUTRALIZING ANTIBODIES IN SERUM FROM ARTIFICIALLY INFECTED RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 28(6): 875-877.

Rainbow trout (Salmo gairdneri) kept in a tank with tap water supply for 18 months at a water temperature of 8-13 C were given monthly intraperitoneal injections of nonpathogenic cell-culture-derived Egtved virus. After 1 year, a low titer of neutralizing antibodies to Egtved virus could be demonstrated in the trout serum. Such antibodies could not be demonstrated by the method applied in sera from rainbow trout exposed to natural infection with Egtved virus at two Danish trout farms. (Auth.)

14036. Alderdice, D. F., and C. R. Forrester (Fish. Res. Bd. Canada, Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1971. EFFECTS OF SALINITY, TEMPERATURE, AND DISSOLVED OXYGEN ON EARLY DEVELOPMENT OF THE PACIFIC COD (Gadus macrocephalus). J. Fish. Res. Bd. Canada, 28(6): 883-902.

Effects of various combinations of levels of salinity, temperature, and dissolved oxygen on incubation of Pacific cod (Gadus macrocephalus) eggs were investigated in the laboratory. Quantitative relations were determined, by response surface analysis, between the environmental variables and four criteria used to estimate success of egg development. Larval size at mean hatching time, and percentages of total hatch, viable hatch, and postmature eggs that failed to hatch were optimized at intermediate salinities (about 15 °/oo), low temperatures (3-5 C), and over a wide range of dissolved oxygen concentrations. Pacific cod eggs are judged to be euryhaline, euryoxic, and stenothermal. As long as temperatures are within the range of about 3-5 C, the developing egg is tolerant of a wide range of salinities, and of dissolved oxygen levels to a minimum of about 2 or 3 ppm. Below 3 C developmental success decreases precipitously; above 5 C it attenuates more slowly. Distribution and abundance of Pacific cod are reviewed in light of the experimental results. Temperature is suggested to be of major importance to successful egg development in the natural environment; the temperature range associated with reasonable egg viability and incubation success is estimated to extend from about 2.5 to 8.5 C. The distribution of cod in the spawning season appears associated with water temperatures between 2.5 and 8.5 C in Asian waters. Near the southern limit of cod distribution on the North American coast the following associations are suggested in relation to temperatures of the upper mixed layer of coastal waters in the spawning period: limit of commercial abundance, 9 C; extent of limited commercial landings, 10 C; limit of occurrence, 13.5 C. (Authors)

14037. Holmes, John C. (Dept. of Zool., Univ. of Alberta, Edmonton, Alberta, Canada). 1971. HABITAT SEGREGATION IN SANGUINICOLID BLOOD FLUKES (DIGENEA) OF SCORPAENID ROCKFISHES (PERCIFORMES) ON THE PACIFIC COAST OF NORTH AMERICA. J. Fish. Res. Bd. Canada, 28(6): 903-909.

Aporocotyle macfarlani Holmes, 1971, was found in five species of Sebastes taken from the inland waters around the San Juan Islands, Washington, or the inshore waters around Vancouver Island, B. C. Psettarium sebastodorum Holmes, 1971, was found in 14 species of Sebastes from the same locations or from deeper offshore waters west of Vancouver Island. The two flukes have different dominant hosts. Their numbers show different relations with depth. Aporocotyle macfarlani appears to be associated with fish that frequent reefs. Aporocotyle macfarlani occupies the lumen of the afferent branchial arteries, the ventral aorta, and rarely parts of the heart; P. sebastodorum is threaded into the intertrabecular spaces of the ventricle and atrium. The overlap in the distributions of the two species is reduced in concurrent infections. (Auth.)

14038. MacLean, J. A., and John H. Gee (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1971. EFFECTS OF TEMPERATURE ON MOVEMENTS OF PRESPAWNING BROOK STICKLEBACKS, Culaea inconstans, IN THE ROSEAU RIVER, MANITOBA. J. Fish. Res. Bd. Canada, 28(6): 919-923.

During spring, brook sticklebacks (Culaea inconstans (Kirtland)) in the Roseau River, Man., moved upstream from deep, cool, overwintering areas to shallow warmer waters in meltwater ponds and ditches, where they reproduced. Movement upstream occurred during daylight, in water velocities less than 90 cm/sec, when a temperature gradient was present, but ceased at night or when water temperatures exceeded 19-20 C. In a horizontal laboratory gradient, prespawning sticklebacks from the field selected a range of temperatures from 14.9 to 20.2 C, considerably narrower than after spawning. More prespawning sticklebacks moved upstream in an artificial stream tank at water temperatures of 15.6 and 21.1 C than at 7.2, 10.0, or 23.9 C, and more moved upstream in light than in darkness. (Authors)

14039. McCormick, J. Howard, Bernard R. Jones, and Roll F. Syrett (Environ. Protection Agency, Water Qual. Office, Nat. Wat. Qual. Lab., Duluth, Minnesota). 1971. TEMPERATURE REQUIREMENTS FOR GROWTH AND SURVIVAL OF LARVAL CISCOS (Coregonus artedii). J. Fish. Res. Bd. Canada, 28(6): 924-927.

Temperatures above 13 and below 18 C are recommended as most suitable for sustained production of larval cisco, as indicated by instantaneous rates of gro h, mortality, and net biomass gain in cisco reared at seven constant temperatures from 3 to 21 C. Growth rates increased in the temperature range from 3 through 18 C. Mortality rates were low from 3 through 13 C, but increased significantly between 13 and 18 C. Net rates of biomass gain were maximum at 13 through 18 C. The 24-hr median lethal temperature for ciscos acclimated to 3 C was calculated to be 19.8 C. (Authors)

14040. Cowey, C. B., J. A. Pope, J. W. Adron, and A. Blair (Natural Environ. Res. Council Fish. Biochem. Res. Unit, Univ. of Aberdeen, Aberdeen, Scotland, United Kingdom). 1971. STUDIES ON THE NUTRITION OF MARINE FLATFISH. GROWTH OF THE PLAICE Pleuronectes platessa ON DIETS CONTAINING PROTEINS DERIVED FROM PLANTS AND OTHER SOURCES. Marine Biology, 10(2): 145-153.

The growth of 0-group Pleuronectes platessa L. on diets containing plant proteins was examined. Diets were made acceptable to the fish by including in them cod flesh which had been predigested with proteolytic enzymes, as well as a proportion of air-dried cod meal. A leaf-protein concentrate was fed at 6 levels ranging from 0 to 63% of the total dietary protein; B. P. protein concentrate (Toprina) and soyabean meal were examined at a single level - about 45% of the dietary protein. The remainder of the protein in these diets was animal protein, cod meal or cod flesh. Analysis of the weight gains after a 12 week feeding period and of the growth curves showed that, as the proportion of leaf protein in the diet increased, the growth rate diminished, the effect becoming more pronounced when leaf protein reached 40% or more of the dietary protein. Growth on the diet containing B. P. protein concentrate was superior to that on the diet containing soyabean meal and was comparable with diets containing low levels of leaf protein. The protein efficiency ratios (PER = g live weight gain/g protein fed) for the different diets showed similar trends to the growth rates. Diets containing 40% or less of leaf protein and the B. P. protein diet had PERs of 1.4 to 1.5. The soyabean meal diet and diets containing more than 40% of the protein as leaf protein had PERs of 1.0 or less. The results are considered in the context of production diets for flatfish. (Authors)

14041. Fraizier A., and A. Vilquin (Commissariat a l'Energie Atomique, Departement de la Protection Sanitaire, Laboratoire de Radioecologie Marine, Centre de la Hague; Cherbourg, France). 1971. AN EXPERIMENTAL STUDY OF ^{137}Cs ELIMINATION IN THE MULLET Mugil chelo AND THE BLENNY Blennius pholis. (Etude experimentale de l'elimination du ^{137}Cs chez le mulet Mugil chelo et la blennie Blennius pholis). Marine Biology, 10(2): 154-156.

Study of the decontamination of two species of marine fishes (Mugil chelo Cuv. and Blennius pholis L.) contaminated by ^{137}Cs reveals two distinct elimination stages: one fast, the other slow; the corresponding biological half-lives have been determinated: for the fast stage it ranges from 20 to 30 days for both species; for the slow stage it is 154 days for M. chelo and 203 days for B. pholis. (Authors)

14042. Nordeng, Hans (Zool. Lab., Univ. of Oslo, Box 1050, Oslo 3, Norway). 1971. IS THE LOCAL ORIENTATION OF ANADROMOUS FISHES DETERMINED BY PHEROMONES? Nature, 5319(233): 411-413.

Studies with arctic char yielded results which support White's suggestion that the standing fish population in a river conditions the water in such a way that individuals on their way back from the sea recognize the stream in which their relatives are living. The attractant may be substances in the mucus excreted.

14043. Stauffer, Thomas M. 1971. SALMON EGGS AS FOOD FOR STREAM SALMONIDS AND SCULPINS. Mich. Dept. of Natural Resources Research and Development Report No. 233, 10 p.

The object of this study was to ascertain the extent that salmon eggs are utilized as food by small salmon, trout, and slimy sculpins (Cottus cognatus). Age-0 fish, in general, ate few salmon eggs. Coho salmon ate more eggs than did the smaller rainbow and brown trout. Average daily ration was less than one egg. Age-I trout fed more on eggs; their average daily ration was 2 to 8, and most were feeding on eggs. Stream-resident, age-II or older brook, brown and rainbow trout ate many eggs; their average daily ration was 9 to 31, and practically all had eaten eggs. All lake-run rainbow trout fed heavily on eggs; their average daily ration was as high as 71. Sculpins fed but little on salmon eggs. -- Robert M. Howland

14044. Wickham, Donald A. (NMFS, Exploratory Fishing and Gear Research Base, Pascagoula, Mississippi). 1971. SALTWATER RECIRCULATION SYSTEM AND LABORATORY AT THE EXPLORATORY FISHING AND GEAR RESEARCH BASE, PASCAGOULA, MISSISSIPPI. NOAA Technical Report NMFS Circ. 355, 7 p., illus.

An approximately 10,000-gal capacity saltwater recirculation system and laboratory were built to conduct controlled behavioral studies of the responses of fish to harvesting gear. This facility consists of an 18-ft diameter by 4-1/2 ft deep pool, a 4-ft deep by 15-ft long rectangular tank, and several water tables. Design compromises resulting from space limitations and construction of the laboratory in an existing one-story structure are discussed. Techniques using a commercial swimming pool diatomaceous-earth filter for removing iron precipitate from the subsurface salt water and particulate matter from the high salinity wedge river water used to supply the system are described. The system's components and operation are also briefly described. (Auth.)

14045. Foster, Neal R., and John Cairns, Jr. (Academy of Natural Sciences of Philadelphia, Pennsylvania). 1966. EFFECTS OF ALKYL BENZENE SULFONATE ON BREEDING BEHAVIOR OF FLAGFISHES, Jordanella floridae. The ASB Bull., 13(2): 34 p.; Selected Water Resources Abstracts, 4(12): p. 42.

The Florida flagfish, Jordanella floridae Goode and Bean, is well suited for bioassays involving effects of toxicants in breeding behavior. Under optimum conditions, these killifishes spawn virtually daily in laboratory aquaria. Male flagfishes occupy specific bottom territories and defend these. A female can enter a male's territory and solicit spawning by undergoing a color change and 'backing' towards him in a distinctive fashion. After spawning, the male fans the substrate where the eggs were laid. Under test conditions, flagfish exhibit normal breeding behavior for at least four days' exposure to an introduced concentration of 6 p.p.m. alkyl benzene sulfonate mixture (54.8% active ingredients). Significantly less breeding behavior was observed, and no viable eggs were recovered, in concentrations of 11.5 p.p.m. and 24 p.p.m. ABS mixture.

14046. Trams, Eberhard G., and Elise A. B. Brown (Nat. Inst. of Neurological Disease and Stroke, Bethesda, Maryland Lab. of Neurochemistry, Bethesda, Maryland). 1970. METABOLISM OF QUINALDINE (2-METHYL-QUINOLINE). UPTAKE AND EXCRETION BY NURSE SHARKS. Life Sciences, 9(2): 27-35; Selected Water Resources Abstracts, 4(12): p. 44, 1971.

The studies demonstrated that the uptake and excretion of quinaldine in the nurse shark appear to follow certain rules of kinetics. It was assumed that the rate of uptake and excretion in the experiments was partially dependent on the transport limits of the gills. It was thought conceivable that the lipophilic drug may be absorbed and excreted, in part, by the skin. The preliminary observations on the tissue distribution of quinaldine showed appreciable concentrations in the central nervous system. Quinaldine should become a valuable drug for the handling of a variety of fish.

14047. Holland, H. Tom, and James R. Chambers. 1971. GROWTH, CONDITION, AND FOOD HABITS OF THE INITIAL YEAR-CLASS OF LARGEMOUTH BASS (Micropterus salmoides) IN A NEW FLORIDA IMPOUNDMENT. U. S. Army Corps of Engineers, 400 West Bay Street, Jacksonville, Florida, 22 p.

Growth, condition, and food habits of the 1969 year-class of largemouth bass (Micropterus salmoides) in Lake Ocklawaha, a newly impounded Florida reservoir, were monitored. The young bass attained a mean total length of about 143 mm and weighed 38 g by 1 January 1970. Mean condition factors (K_{TL}) for young bass ranged from 0.824 to 1.227, generally increasing with larger specimen size. Significant increases in condition were positively correlated with changes in water levels. Bass less than 60 mm in length fed primarily on Cladocera, Eucopepoda, Ephemeroptera, Corixidae, and Tendipedidae, whereas larger fish fed primarily on fishes, Corixidae, Odonata, Decapoda, Ephemeroptera, and Tendipedidae. Corixidae were the most frequently consumed food item by bass of all sizes. (Authors)

14048. Gooding, Reginald M. (NMFS, Hawaii Area Fishery Research Center, Honolulu, Hawaii). 1971. OIL POLLUTION ON WAKE ISLAND FROM THE TANKER R. C. STONER. U. S. Dept. of Commerce, NOAA, NMFS, Special Scientific Report--Fisheries No. 636, 12 p., illus.

On September 6, 1967, the tanker R. C. Stoner foundered on the reef off the harbor entrance at Wake Island. During the following 10 days the vessel's cargo of over 22,000 kliters (6 million gal) of high octane aviation gasoline, aviation jet fuel, aviation turbine fuel, diesel oil, and bunker C black oil was spilled along the southern coast of the island. A shore and underwater survey of the contaminated coastline showed that an estimated 2,500 kg of inshore reef fishes were killed and stranded on the shore. Numerous other fish and invertebrates were probably killed. Evidence is cited which indicates that most of the kill occurred on the shallow reef flat and the author speculates on the lethal effect of the various fuels. (Auth.)

14049. International Council for the Exploration of the Sea (Charlottenlund Slot, DK-2920, Charlottenlund, Denmark). 1971. THIRD REPORT OF THE ICES/ICNAF JOINT WORKING PARTY ON NORTH ATLANTIC SALMON. Cooperative Research Report, Series A, No. 24, 36 p.

The first and second reports of the Working Party dealt with the growth of the fishery for salmon off West Greenland in the period up to May 1968, with the results of investigations during this time on the composition, origin and biological features of the salmon concentrations exploited there and with assessments of the effects of the fishery on total and home-waters salmon catches and stocks. This report deals with the further information obtained for this fishery and the assessments made of its effects in the period May 1968 to February 1970; in addition, information is presented on the development of a high seas salmon fishery in the Norwegian Sea, which developed during this period, and of preliminary assessments of its effects on total and home-waters catches and stocks. (Introduction)

14050. Wheat, T. E., and G. S. Whitt (Cell Biol. Program, Univ. of Illinois, Urbana, Illinois). 1971. IN VIVO AND IN VITRO MOLECULAR HYBRIDIZATION OF MALATE DEHYDROGENASE ISOZYMES. Experientia, 27:647-648. In English with French resume translated by Robert M. Howland.

The molecular hybrids of malate dehydrogenase isozymes of different species of fish can be produced in vitro by freezing then thawing the isozymes in the presence of salt. The hybrid isozyme is identical to that observed in vivo in the interspecific F_1 hybrid. (Authors resume)

14051. Beardsley, Grant L., and David C. Simmons (NMFS, Tropical Atlantic Biol. Lab., Miami, Florida). 1971. A BIBLIOGRAPHY OF THE BLACKFIN TUNA, Thunnus atlanticus (Lesson). U. S. Dept. of Commerce, NOAA Technical Report, NMFS SSRF-635, 10 p.

One hundred eighty-four references on the blackfin tuna, Thunnus atlanticus (Lesson), are listed. A subject index is included. (Authors)

14052. Schluter, M. 1969. DETERMINATION OF FISH TOXICITY OF SUBSTANCES IN THE WATER AND TOXIC THRESHOLD VALUES OF HERBICIDES. Z. Fisch., 17(5/7): 457-471; Weed Abstracts, 20(5): Abstr. No. 2373, 1971.

The toxicological hazards of herbicides to fish and methods for their evaluation are considered. Data are provided on herbicides commonly used in aquatic situations including their threshold toxicity values to various fish, and the compounds are categorized according to empirically derived safety factors.

14053. Sanders, H. O. (Fish-Pesticide Res. Lab., Route 1, Columbia, Missouri). 1969. TOXICITIES OF SEVERAL HERBICIDES TO SOME SPECIES OF FRESH WATER CRUSTACEA. Abstr. Meet. Weed Sci. Soc. Am., 100; Weed Abstracts, 20(5): Abstr. No. 2374, 1971.

Static bioassays were conducted to determine the toxicities of several herbicides used in the control of aquatic plants to six species of fresh-water crustacea; Daphnia magna, Gammarus fasciatus, Palaemonetes kadiakensis, Adellus brevicaudus, Cypridopsis vidua and Orconectes nais. D. magna was generally the species most sensitive to the herbicides followed in descending order by C. vidua, P. kadiakensis, G. fasciatus, A. brevicaudus and O. nais.

14054. Walsh, G. E., and P. T. Heitmuller (Bur. of Commercial Fisheries, Gulf Breeze, Florida). 1969. EFFECTS OF DICHLOBENIL UPON PHYSICAL, CHEMICAL, AND BIOLOGICAL FACTORS IN A FRESHWATER POND. Abstr. Meet. Weed Sci. Soc. Am., 92; Weed Abstracts, 20(5): Abstr. No. 2375, 1971.

A w. p. formulation of dichlobenil at 1 ppm was applied to a 0.36-ac pond on 3 April 1968 in order to study its effect on water chemistry and plankton. Potamogeton pectinatus was eradicated and 70-80% of Chara vulgaris was eliminated 4 weeks after application. As benthic plants died, a phytoplankton bloom occurred with phytoplankton chlorophyll increasing from an average of 2.46 mg/l in March to an average of 14.95 mg/l in April but this increase in phytoplankton density did not occur in the control pond. No distinct changes were observed after treatment in conductivity, pH, dissolved carbohydrate, alkalinity, nitrate nitrogen and photosynthesis/respiration ratio. Increased numbers of Diaptomus dorsalis (copepod), Keratella cochlearis, K. quadrata (rotifers), Gonyaulax (dinoflagellate) and the algae Oedogonium, Lyngbya, Oscillatoria and Spirogyra occurred after treatment but Volvox sp. was eliminated. Dichlobenil concns in the water and hydrosoil decreased steadily until negligible amounts were present 64 days after treatment. Residues in P. pectinatus and C. vulgaris were as high as 1.33 and 1.16 ppm respectively. The greatest residue of 10.96 ppm was found in mosquito-fish (Gambusia affinis) one day after treatment. Dichlobenil residues in the plankton were 7.23 ppm one day after treatment but decreased steadily to undetectable amounts after 4 days.

14055. Vestnik Akademii Nauk SSSR. (R; Akad. Nauk SSSR, Mosk. gos. Univ., Moskva, USSR). 1970. THE USE OF HERBIVOROUS FISH IN FISH FARMING AND IN THE WEEDING OF RESERVOIRS. Vest. Akad. Nauk SSSR, No. 11, 26-30; Weed Abstracts, 20(5): Abstr. No. 2163, 1971.

A report by G. V. Nikol'skii and the discussion of it in the Praesidium of the Academy of Sciences of the USSR are reported. It was thought that silver carp (Hypophthalmichthys molitrix) and the bighead (Aristichthys nobilis), which feed on plankton and reach a size of 20 kg, and grass carp (Ctenopharyngodon idella), which feed on higher aquatic plants and reach a size of 30 kg, could be reared north of their customary latitudes in the relatively warm waters of power station cooling reservoirs and keep the profusely growing weeds and algae under control. The total area of cooling reservoirs would soon reach 500 km^2; it was planned to produce 2.5-3 million hkg of herbivorous fish in reservoirs in addition to 2 million hkg in ponds. The stocking of herbivorous fish in ponds in the Krasnodar district reduced the cost of 1 hkg of fish (9 hkg common carp and 13.5 hkg herbivorous fish/ha) from 70 to 44 roubles. Herbivorous fish could be used for weeding collector drains which would have a total length of > 700,000 km in 10 years' time and would otherwise cost 300 million roubles/year to clean. Research into natural reproduction,

acclimatization, effects on reservoir ecology, rearing in mixed fish cultures, breeding of better hybrid species, weed control use and tropical herbivorous fish is suggested. It was agreed to hold a conference on herbivorous fish every 2-3 years.

14056. Weed Research Organization. 1971. RESEARCH ON HERBIVOROUS FISH FOR WEED CONTROL 1957-1971. Agricultural Research Council, Weed Research Organization Annotated Bibliography No. 31, 13 p., 2 app., available from Weed Research Organization, Begbroke Hill, Yarnton, Oxford, England, price, U.K. and overseas surface mail - £ 0.80; overseas airmail - £ 1.20.

14057. Wheat, T. E., W. F. Childers, E. T. Miller, and G. S. Whitt (Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1971. GENETIC AND IN VITRO MOLECULAR HYBRIDIZATION OF MALATE DEHYDROGENASE ISOZYMES IN INTERSPECIFIC BASS (Micropterus) HYBRIDS. Anim. Blood Grps biochem. Genet. 2: 3-14.

Supernatant malate dehydrogenase (MDH) isozymes (as visualized by starch gel electrophoresis) are encoded by two distinct gene loci in both the largemouth and smallmouth bass. When an interspecific F_1 hybrid is formed between these two fish, a unique MDH isozyme is generated. The results of freeze-thaw molecular hybridization (which is the first application of this technique to MDH) indicate that this unique isozyme in the F_1 hybrid is a heterodimer composed of one subunit of each parental type. The F_1 hybrids produced F_2 hybrids which in turn formed the F_3 hybrid population. The inheritance of alleles at the MDH-B locus is consistent with a single Mendelian autosomal locus. Furthermore, there is no evidence of linkage between the lactate dehydrogenase-E locus and the MDH-B locus. (Authors summ.)

14058. Averett, Robert C., and Craig MacPhee. 1971. DISTRIBUTION AND GROWTH OF INDIGENOUS FLUVIAL AND ADFLUVIAL CUTTHROAT TROUT (Salmo clarki), ST. JOE RIVER, IDAHO. Northwest Science, 45(1): 38-47.

The St. Joe River in Northern Idaho terminates at the southern end of Coeur d'Alene Lake. Because of its connection with the lake, it contains both fluvial and adfluvial cutthroat trout. This study was designed to determine the life history of both cutthroat trout types, and to differentiate between the two types on the basis of scale analysis. Specific study areas consisted of the St. Joe River mainstem, two streams tributary to Coeur d'Alene Lake, two streams tributary to the lower St. Joe River, and two streams tributary to the upper St. Joe River. Adfluvial cutthroat leave the lake environment to spawn in the streams in early April. They were found as far as 121 km (75 miles) upstream in the St. Joe River mainstem. Scale analysis showed that 71 percent (N=117) of the adfluvial cutthroat were four years of age when captured. Sixty-two percent of these fish had spent two years in the stream environment before their migration to the lake. Emergent fry from either adfluvial or resident cutthroat were observed in mid-June in the lower tributaries. In the upper tributaries fry emergence was not observed until mid-August. Scale development first takes place when the fish are about 46-mm fork length. Juvenile cutthroat from the lower tributaries had almost the same calculated mean length at the completion of the first annulus, and about the same mean number of included circuli within the first annulus as did adfluvial cutthroat captured on their spawning migration. In contrast, cutthroat from the upper tributaries had a significantly shorter ($P < 0.01$) mean length at the completion of the first annulus, and about one-half as many included circuli as did adfluvial and juvenile cutthroat from the lower tributaries. From these findings, it was speculated that adfluvial cutthroat originate essentially from the lower tributaries and the St. Joe River mainstem. The difference between adfluvial and resident cutthroat in the St. Joe River drainage appears to be behavioral rather than morphological. (Authors)

14059. Jangaard, P. M. 1970. THE ROLE PLAYED BY THE FISHERIES RESEARCH BOARD OF CANADA IN THE "RED" HERRING PHOSPHORUS POLLUTION CRISIS IN PLACENTIA BAY, NEWFOUNDLAND. A.R.O. Circular No. 1, 20 p., illus.

14060. Kemp, P. H. (Natal Reg. Lab., National Inst. for Water Research, Durban, South Africa). 1971. CHEMISTRY OF NATURAL WATERS - II. ALKALINITY. Water Research, 5(7): 413-420.

The alkalinity of natural waters and its determination by electrometric titration is discussed. Consideration is given to its stoicheiometric division into bicarbonate, carbonate and hydroxide forms, and these are shown to be related to the corresponding ionic concentrations. Comparison of the values of the total alkalinity found by titration and calculation is found to be a useful check on the accuracy of a water analysis. (Auth.)

14061. Pannella, Giorgio (Dept. of Goelogy and Geophysics, Yale University, New Haven, Connecticut). 1971. FISH OTOLITHS: DAILY GROWTH LAYERS AND PERIODICAL PATTERNS. Science, 173(4002): 1124-1127, illus.

The early-stage annual rings in otoliths from some cold-temperate fish consist of thin growth bands, the number of which corresponds to that of the days in a year. This indicates that growth takes place by daily increments. Other recurrent patterns show a fortnightly and monthly periodicity. Spawning rings are microscopically distinguishable from winter rings. (Auth.)

14062. Janicki, Ralph H., and William B. Kinter (Mt. Desert Island Biol. Lab., Salisbury Cove, Maine). 1971. DDT: DISRUPTED OSMOREGULATORY EVENTS IN THE INTESTINE OF THE EEL Anguilla rostrata ADAPTED TO SEAWATER. Science, 173(4002): 1146-1147.

The drinking of seawater and absorption of water along with sodium across the intestinal epithelium are well-known osmoregulatory events in marine teleosts. The insecticide DDT impairs fluid absorption in intestinal sacs from eels adapted to seawater. Furthermore, this functional impairment has an enzymatic basis; DDT also inhibits the (Na^+ and K^+) activated, Mg^{2+}-dependent adenosine triphosphatase in homogenates of the intestinal mucosa. Thus, the extreme sensitivity of teleosts to organochlorine pollutants may involve the disruption of osmoregulatory transport mechanisms. (Authors)

14063. Aron, William I., and Stanford H. Smith. 1971. SHIP CANALS AND AQUATIC ECOSYSTEMS. Science, 174(4004): 13-20.

Through a combination of ecosystem homeostasis and the perversity of man and nature, oftentimes the significant biological changes effected by environmental modifications are not detected until long after the initial change has taken place. The immediate impact, which may range from the spectacular to the undetectable, is a deceptive measure of the long-term and often more important changes in the ecosystem. Two major engineering achievements illustrate this premise: (i) construction of the Erie Canal, which provided access from the Atlantic Ocean to the Great Lakes, and the Welland Canal, which bypassed the block between Lakes Ontario and Erie created by Niagara Falls, and (ii) construction of the Suez Canal between the Red Sea and the Mediterranean Sea. The Erie Canal was opened to Lake Ontario in 1819 and to Lake Erie in 1825, and the Welland Canal was opened in 1829. The Suez Canal was opened in 1869. In both areas there was a long lag between the physical connection and the appearance of major biological changes. In the Great Lakes the changes, when they finally occurred, were explosive and resulted in major shifts in the abundance, composition, distribution, and growth of the fish fauna throughout the lakes. Changes that followed the opening of the Suez, although more gradual, were also dramatic. These examples serve as a backdrop to speculations about the biological implications of the proposed sea-level canal in Central America. (Authors introduction)

14064. FAO of the United Nations (Rome, Italy). 1971. A LIST OF INLAND FISHERY WORKERS IN EUROPE. FAO Fisheries Technical Paper No. 15, Revision 2, 85 p., (distribution restricted).

This document contains names of persons who had returned specially designed information forms or amendments to already submitted forms, after April 1968 and before January 1971. This document is a complete revision of "FAO Fish. tech. Pap., (15) Rev. 1:80 p., 1964.

14065. Dean, Robert B., Robert T. Williams, and Robert H. Wise (Environmental Protection Agency, Water Quality Office, Cincinnati, Ohio). 1971. DISPOSAL OF MERCURY WASTES FROM WATER LABORATORIES. Environmental Science & Technology, 5(10): 1044-1045.

Procedures for the ecologically satisfactory recovery or disposal of mercury-containing wastes, generated at water laboratories and other laboratories, are described. Suggestions for the prevention of potentially hazardous conditions in the laboratory are also presented. (Authors)

14066. Higgs, D. A., and J. G. Eales (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1971. IODIDE AND THYROXINE METABOLISM IN THE BROOK TROUT, Salvelinus fontinalis (Mitchill), DURING SUSTAINED EXERCISE. Canad. J. Zool., 49(9): 1255-1269.

Iodide and thyroxine metabolism were followed in exercised and non-exercised starved trout. Radioiodide (^{125}I) parameters suggested a slight increase in thyroid activity (% dose in thyroid, thyroid/serum ratio (T/S), and conversion ratio (CR)) and an increase in extrathyroidal ^{125}I excretion resulting from exercise. The generally high and variable serum ^{127}I levels increased up to 496 µg% during the experiments, being consistently higher in exercised fish. Individual variations in serum ^{127}I were related in many instances to radioiodide parameters (^{125}I, T/S, CR) and to a limited extent to % thyroid. This demonstrates the uncertainty of radioiodide measurements when the specific activity of circulating ^{125}I changes and the need for assessing ^{127}I levels in radioiodide studies. Tissue uptake of radioactivity and serum loss of protein-bound radioactivity following radiothyroxine intraperitoneal injection, as well as serum stable thyronine levels, suggested both increased biliary loss of thyroid hormones and a higher thyroid hormone secretion rate as a result of exercise. (Authors)

14067. Chittenden, Mark E., Jr. (Virginia Inst. of Marine Science, Gloucester Point, Virginia). 1971. STATUS OF THE STRIPED BASS, Morone saxatilis, IN THE DELAWARE RIVER. Chesapeake Science, 12(3): 131-136.

The Delaware River was historically an important spawning and nursery area for striped bass, particularly in and near tidal fresh water. Collections of fishes throughout the freshwater sections from 1963 to 1966 by techniques that included continuously fishing traps and large and small meshed seines contained no striped bass, and few specimens were collected in rotenone surveys from 1960 to 1962. Gross pollution of the tidal freshwater area has destroyed its potential as a spawning and nursery area, has resulted in the virtual extirpation of the striped bass from there and upstream waters, and is the probable cause of the decline in abundance of this species in the Delaware River. Major restoration of striped bass would occur if pollution is decreased so that the tidal freshwater section can resume its former importance as a spawning and nursery area. (Auth.)

14068. Fontaine, Maurice, and Jacques Marchelidon (Laboratoire de Physiologie générale et comparée, Muséum National d'Histoire Naturelle; Laboratoire d'Endocrinologie comparée associé au CNRS, 7 rue Cuvier, Paris 5°). 1971. AMINO ACID CONTENTS OF THE BRAIN AND THE MUSCLE OF YOUNG SALMON (Salmo salar L.) AT PARR AND SMOLT STAGES. Comp. Biochem. Physiol., 40(1A): 127-134.

During the parr-smolt transformation of Salmo salar L. in fresh water, variations in the concentration of some free amino acids in the brain and the muscle are observed. An increase of threonine and glutamine in the brain and a decrease of the total free amino acids - particularly glycine and taurine - in the muscle are especially important. The results are discussed in relation with the migratory behaviour and hydromineral regulation. (Authors)

14069. FAO of the United Nations (Rome, Italy). 1971. REPORT OF THE THIRD SESSION OF THE IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN JOINT GROUP OF EXPERTS ON THE SCIENTIFIC ASPECTS OF MARINE POLLUTION (GESAMP). FAO Fisheries Reports, No. 102, 9 p. plus 9 annexes.

14070. Smith, Albert C. (Div. of Nat. Sci., Univ. of Hawaii at Hilo, Hilo Coll., P. O. Box 1357, Hilo, Hawaii). 1971. THE SOLUBLE PROTEINS IN EYE LENS NUCLEI OF ALBACORE, BLUEFIN TUNA AND BONITO. Comp. Biochem. Physiol., 39(4B): 719-724.

Many samples of nuclear lens protein can now be electrophoretically processed at the same time, facilitating the identification of populations and the detection of rare protein variants. Multiple, simultaneous electrophoretic patterns of protein were prepared from lens nuclei of albacore, bluefin tuna and bonito. No variation was found among the albacore patterns. However, while acidic protein polymorphism, which is common, was revealed in the bluefin patterns, the bonito patterns revealed a rare polymorphism - a variably present, highly basic protein. Variation in protein concentration is apparently controlled by multiple genes. (Auth.)

14071. Freed, James M. (Dept. of Physiol. and Biophysics, Univ. of Ill., Urbana, Illinois). 1971. PROPERTIES OF MUSCLE PHOSPHOFRUCTOKINASE OF COLD- AND WARM-ACCLIMATED Carassius auratus. Comp. Biochem. Physiol., 39(4B): 747-764.

Phosphofructokinase (PFK) activity of homogenate supernatants of 5°C-acclimated goldfish is slightly more than that of 25°C-acclimated goldfish when measured at 5° and 15°C, but not at 25°C. Muscles of warm-acclimated goldfish have a large increase relative to 5°C fish in several glycolytic intermediates and adenine nucleotides; the increases in fructose-6-phosphate (F-6-P) and glucose-6-phosphate (G-6-P) appear within 3 hours after the fish are exposed to the selected temperature. Magnesium inhibits PFK at higher temperatures (25°C); citrate inhibits less at higher than at lower assay temperatures. Goldfish muscle PFK activity changes markedly within a small pH range, and it is suggested that if goldfish muscle intracellular pH decreases in warm acclimation, this pH decrease, by its action on PFK, would cause the observed effects of decreased glycolytic rate and increased levels of F-6-P and G-6-P. (Auth.)

14072. Utter, Fred M. (NMFS, Biol. Lab., 2725 Montlake Blvd. East, Seattle, Washington). 1971. TETRAZOLIUM OXIDASE PHENOTYPES OF RAINBOW TROUT (Salmo gairdneri) AND PACIFIC SALMON (Oncorhynchus spp.). Comp. Biochem. Physiol., 39(4B): 891-895.

A broad range of tetrazolium oxidase mobility was found among rainbow trout (Salmo gairdneri) and Pacific salmon (Oncorhynchus) native to North America. Three forms of polymorphisms in rainbow trout and chinook salmon (O. tshawytscha) were interpreted as reflecting allelic relationships. Three-banded heterozygous phenotypes suggested that the active enzyme is a dimer. Similar gene frequencies were observed for rainbow trout sampled over a broad geographic range; a significant difference in gene frequencies was found between chinook salmon taken from high seas areas of the North Pacific Ocean and those from Seattle, Washington. (Auth.)

14073. Snelson, Franklin F., Jr. 1971. Notropis mekistocholas, A NEW HERBIVOROUS CYPRINID FISH ENDEMIC TO THE CAPE FEAR RIVER BASIN, NORTH CAROLINA. Copeia, No. 3, 449-462.

Notropis mekistocholas is described as a new species. It is unusual within the genus in exhibiting herbivorous adaptations - an elongate, convoluted intestine and black peritoneum. It is compared with N. alborus and N. procne, two sympatric relatives that differ in lacking herbivorous modifications, in having seven rather than eight anal rays, and in numerous other features. N. mekistocholas is the first known endemic species from the Cape Fear drainage in North Carolina. It has a very restricted distribution in the east-central Piedmont province, being known from only four streams in Chatham and Harnett counties. Intestinal modifications suggestive of an herbivorous diet are reported for N. anogenus and some species of the subgenus Luxilus. There is no evidence to suggest that N. mekistocholas should be aligned with the southwestern genus Dionda, which contains herbivorous species superficially similar to Notropis species. Closet relatives of N. mekistocholas appear to be N. procne and N. stramineus.

14074. Banks, J. W. (Dept. of Zool., Univ. of Liverpool, England). 1970. OBSERVATIONS ON THE FISH POPULATION OF ROSTHERNE MERE, CHESHIRE. Fld Stud., 3(2): 357-379.

Rostherne Mere is a deep natural lake with a steep shore profile. It has extensive reed bed but rather little shallow open water. It is highly productive. The lake was fished with gill nets and funnel traps for 2-1/2 years. The fish population is mainly roach, perch and pike. Curves of length for age, and regressions of weight on length were produced for these three species. Rostherne roach are the fastest growing British population so far described. The growth of perch was also fast but that of pike is rather slow. The representation of year classes in the roach population was very uneven, 75% belonged to the 8+ age group and a further 13% were 4+. This could not be explained by selective sampling. The analysis of food of roach was only qualitative, but for perch and pike both the occurrence and points methods were used. Perch of more than 6 cm. fed largely on emerging chironomids in spring and early summer, then all age groups switched to cannibalism on their own fry. Pike fed predominantly on perch. The correlation in pike between predator size and prey size was less well marked than in Windermere, but estimations of the relative importance of various size groups of prey showed that although the large pike took many fry, the bulk of their food was derived from a small number of large prey. Some data on the development of gonads, times of spawning and on sex ratios are also recorded. (Auth.)

14075. Coastal Plains Center for Marine Development Services (Wilmington, No. Carolina). 1971. PROCEEDINGS SPORT FISHING SEMINAR, OCTOBER 8-9, 1970. MYRTLE BEACH, SOUTH CAROLINA. Coastal Plains Center for Marine Development Services, Seminar Series No. 2, 76 p.

Text includes: The coastal zone management system; The case for commercial fisheries; Economics of sport fishing; Support facilities, public and private; Sport fishing, conservation and development from the viewpoint of a county official; Sport fishing, conservation and development from the viewpoint of a state official; Importance of estuaries to coastal zone fisheries; Sport fishing, conservation and development from the viewpoint of a federal official; Fishery research, the mainspring of sport fisheries development. (From contents)

14076. Lindahl, P. E., and E. Schwanbom (Inst. of Zoophysiology, Univ. of Uppsala, Sweden). 1971. A METHOD FOR THE DETECTION AND QUANTITATIVE ESTIMATION OF SUBLETHAL POISONING IN LIVING FISH. Oikos, 22(2): 210-214. Copenhagen.

In order to detect sublethal poisoning in living fish, they are subjected to flowing water that is caused to rotate in a narrow tube around the direction of flow. On acceleration from zero to the maximum number of revolutions per minute (40 or 60 r. p. m.) the "critical r. p. m." is that at which the fish is unable to compensate for the torque and is forced to rotate. Sublethal poisoning with methylmercuric hydroxide (MM_2-OH) significantly decreases the critical r. p. m. as does a stay in captivity without food. The decrease in the critical r. p. m. of fishes exposed to MM-OH is linearly correlated to the amount of mercurial found per unit wet weight of muscles. (Authors)

14077. Yoder, Warren G. 1971. THE SPREAD OF WHIRLING DISEASE, Myxosoma cerebralis, INTO NATIVE TROUT POPULATIONS IN MICHIGAN. Mich. Dept. of Natural Resources, Research and Development Report No. 230 (Institute for Fisheries Research Report No. 1775), 12 p.

Whirling disease of salmonids, caused by Myxosoma cerebralis, was discovered in north-central Michigan in 1968. Examinations of trout 2 years later revealed that this disease had spread from infected rainbow trout (Salmo gairdneri) in the hatchery to native brook trout (Salvelinus fontinalis) and brown trout (Salmo trutta). These infected native trout were collected from the 6-7 miles of stream below the infected source. Brook trout had a higher incidence of whirling disease than did the brown trout, although both species were in nearly equal abundance. (Auth.)

14078. Pang, Peter K. T. (Bingham Lab., Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. THE RELATIONSHIP BETWEEN CORPUSCLES OF STANNIUS AND SERUM ELECTROLYTE REGULATION IN KILLIFISH, Fundulus heteroclitus. J. Exp. Zool., 178(1): 1-8.

Corpuscles of Stannius were surgically removed from male killifish, Fundulus heteroclitus, acclimated to one third Long Island Sound sea water. Asthenia and kidney stone formation were observed. An increase in serum total and dialytic calcium, chloride and potassium and a decrease in serum sodium and inorganic phosphate were evident. No change in serum magnesium was observed. Injections of homogenates of codfish corpuscles of Stannius into intact male killifish adapted to fresh or sea water produced a significant decrease in serum total calcium in sea water fish only. (Auth.)

14079. Pang, Peter K. T. (Bingham Lab., Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. THE EFFECTS OF COMPLETE DARKNESS AND VITAMIN C SUPPLEMENT ON THE KILLIFISH, Fundulus heteroclitus, ADAPTED TO SEA WATER. I. CALCIUM METABOLISM AND GONADAL MATURATION. J. Exp. Zool., 178(1): 15-22.

Adaptation to complete darkness for eight months had no effect on calcium metabolism in adult male Fundulus heteroclitus in sea water. However, scoliosis and hypocalcemia were evident in juvenile killifish kept in complete darkness for six and a half months. Hypocalcemia was also seen in juveniles after three and a half months in complete darkness but this fall in serum calcium level was prevented by vitamin C supplement in the diet. Complete darkness also induced a delay in testicular maturation in both adults and juveniles but this defect was not corrected by vitamin C supplement. (Auth.)

14080. Liversage, Richard A., Brian W. Price, W. Craig Clarke, and David G. Butler (Ramsey Wright Zool. Lab, Univ. of Toronto, Canada, and Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. PLASMA ADRENOCORTICOSTEROID LEVELS IN ADULT Fundulus heteroclitus (KILLIFISH) FOLLOWING HYPOPHYSECTOMY AND PECTORAL FIN AMPUTATION. J. Exp. Zool., 178(1): 23-28.

Adult male and female Fundulus heteroclitus (killifish) were used in experiments designed to measure the plasma corticosteroid levels in control regenerate, sham hypophysectomized, hypophysectomized and intact fish ten days after pectoral fin amputation. Our data provide evidence for an anterior pituitary - adrenocortical axis in this fish since hypophysectomy was followed by a significant decrease in the plasma adrenocorticosteroid levels. The data also indicate that plasma adrenocorticosteroids are not abolished ten days after hypophysectomy. Cortisol is the major adrenocorticosteroid in this species although lesser amounts of corticosterone were also detected. The use of metopirone failed to reduce adrenocorticosteroid levels further in the hypophysectomized fish. In the presence of only low titres of adrenocorticosteroids our hypophysectomized fish survived and fin regeneration ensued for the ten days duration of the experiments. (Authors)

14081. Joseph, M. M., and Albert H. Meier (Dept. of Zool. and Physiol., La. State Univ., Baton Rouge, Louisiana). 1971. DAILY VARIATIONS IN THE FATTENING RESPONSE TO PROLACTIN IN Fundulus grandis HELD ON DIFFERENT PHOTOPERIODS. J. Exp. Zool., 178(1): 59-62.

Gulf killifish were placed on three different photoperiods (8L:16D; 12L:12D; 16L:8D) and injected daily for six days with prolactin at one of several times during the day. Gains in fat stores resulted from prolactin injections given eight hours after the onset of light regardless of the length of the photoperiod. Prolactin injections at other times of the day did not stimulate fattening. These results suggest that the endogenous system controlling the daily fattening response to prolactin is phased by the onset of light. (Authors)

14082. Fraser, Thomas H., and Warren C. Freihofer (J. L. B. Smith Inst. of Ichthyology, Rhodes Univ., Grahamstown, So. Africa). 1971. TRYPSIN MODIFICATION FOR SIHLER TECHNIQUE OF STAINING NERVES FOR SYSTEMATIC STUDIES OF FISHES. Copeia, No. 3, 574-576.

14083. Pang, Peter K. T. (The Bingham Lab., Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. CALCITONIN AND ULTIMOBRANCHIAL GLANDS IN FISHES. J. Exp. Zool., 178(1): 89-100.

Ultimobranchial bodies in fishes contain follicles or cords of cells which show features of endocrine secretion. Hypocalcemic activities are present in the ultimobranchial bodies of sharks, bony fish and lungfish. Amino acid sequence of salmon calcitonin has been revealed and this hormone has been synthesized in vitro. Administration of mammalian and fish calcitonins has no effect on serum calcium levels of sharks, channel catfish, killifish and coho salmon. Mammalian and fish calcitonins elicit hypocalcemia and hyperphosphatemia in fresh water eels but not in sea water eels. Glandular hyperactivity can be related to calcium metabolism only in some cases. An osmoregulatory function of the gland has been suggested. The activity of this gland seems to be under pituitary control. (Auth.)

14084. Miller, Lee W. (Anadromous Fish. Br., Dept. of Fish and Game, California). 1971. THE STURGEON PARTY BOAT FISHERY 1964-69. The Resources Agency, Dept. of Fish and Game, State of California, 10 p.

Two species of sturgeon inhabit the Sacramento-San Joaquin estuary, the white sturgeon (Acipenser transmontanus Richardson) and the green sturgeon (Acipenser medirostris Ayres). During the latter part of the 19th and early 20th centuries, these stocks were overfished. The fishery was closed from 1917 until 1954 when the Fish and Game Commission established an open season with a one-day bag limit. The fishery really developed in 1964 when shrimp began to be used as bait. This report summarizes the party boat portion of the sturgeon fishery since 1964. White sturgeon dominate the catches although green sturgeon are also caught occasionally. The sturgeon party boat fishery appears to be a stable fishery in its initial 6 years. This is indicated by the catch per unit of effort and the average size of fish in the catch. Exploitation rates previously calculated indicate a rather low exploitation rate for the total sturgeon fishery. As long as recruitment is adequate, the party boat fishery will likely retain this stability. Future measures of the party boat catch will be important in determining the effect of the California Water Plan on recruitment to the sturgeon population.

14085. Smith, M. W., and J. C. Ellory (Agric. Res. Council Inst. of Animal Physiol., Babraham, Cambridge, England). 1971. TEMPERATURE-INDUCED CHANGES IN SODIUM TRANSPORT AND Na^+/K^+-ADENOSINE TRIPHOSPHATASE ACTIVITY IN THE INTESTINE OF GOLDFISH (Carassius auratus L.). Comp. Biochem. Physiol., 39(2A): 209-218.

The transfer of sodium and fluid across everted sacs of goldfish intestine fell to half the control values 18-24 hr after raising the environmental temperature from 16 to 30°C. The Na^+/K^+-ATPase activity fell in membranes prepared from 16°C adapted fish kept at 30°C but this took 20 days to become apparent. The amount of tritiated ouabain bound to membranes prepared from the intestines of 16°C adapted fish was the same as that bound to membranes prepared from 16°C adapted fish kept at 30°C for 20 days. The time course of ouabain binding was also the same, both in the presence and absence of ATP. The ATP-dependent binding was 4 times the non-specific binding. The turnover number for the Na^+/K^+-ATPase system (ATPase activity/amount of ATP-dependent bound ouabain) fell by one third when 16°C adapted fish were kept at 30°C for 20 days. The turnover numbers for Na^+/K^+-ATPase from fish kept at 30°C for shorter periods of time were not significantly different from those obtained from the 16°C adapted fish. The discrepancy between the time taken for sodium transport and Na^+/K^+-ATPase activity to adapt suggests that the two are not directly related. (Authors)

14086. FAO of the United Nations, (Rome, Italy). 1971. REPORT OF THE SEMINAR ON METHODS OF DETECTION, MEASUREMENT AND MONITORING OF POLLUTANTS IN THE MARINE ENVIRONMENT. SUPPLEMENT TO THE REPORT OF THE TECHNICAL CONFERENCE ON MARINE POLLUTION AND ITS EFFECTS ON LIVING RESOURCES AND FISHING. FAO Fisheries Report, No. 99, Suppl. 1, 123 p.

14087. Taylor, E. W., and P. J. Butler (Dept. of Zool. and Comp. Physiol., Univ. of Birmingham, England). 1971. SOME OBSERVATIONS ON THE RELATIONSHIP BETWEEN HEART BEAT AND RESPIRATORY MOVEMENTS IN THE DOGFISH (Scyliorhinus canicula L.). Comp. Biochem. Physiol., 39(2A): 297-305.

Blood pressure recordings from the ventral and dorsal aortae bore pressure pulses resulting from the action of the buccal respiratory pump. There was no evidence of any maintained synchrony between heart-beat and respiratory movements. Blood pressure and vagal tone on the heart seemed unimpaired and the $P_a O_2$ in normoxic water was high. (Authors)

14088. Butler, P. J., and E. W. Taylor (Dept. of Zool. and Comp. Physiol., Univ. of Birmingham, England). 1971. RESPONSE OF THE DOGFISH (Scyliorhinus canicula L.) TO SLOWLY INDUCED AND RAPIDLY INDUCED HYPOXIA. Comp. Biochem. Physiol., 39(2A): 307-323.

In response to slowly induced hypoxia the unanaesthetized dogfish showed a significant reduction in heart rate as the P_I, O_2 fell below 70 mm Hg (P_a, O_2 45 mm Hg). Rapidly induced hypoxia caused an initial intense bradycardia, accompanied by a transient hypotension in the dorsal and ventral aortae. As the P_I, O_2 reached a steady level, however, heart rate increased to a value characteristic of that PI, O_2. Injection of atropine abolished the chronotropic and hypotensive responses to hypoxia. (Authors)

14089. Kutchai, Howard (Inst. of Physiol., Univ. of Oslo, Oslo, Norway). 1971. ROLE OF CARBONIC ANHYDRASE IN LACTATE SECRETION BY THE SWIMBLADDER. Comp. Biochem. Physiol., 39(2A): 357-359.

The rate of lactate release by the swimbladder of the eel Anguilla anguilla was measured in vitro. Adrenalin and histamine had no marked effect on the rate of lactate release. Acetazoleamide, a potent inhibitor of carbonic anhydrase, markedly reduced the rate of lactate release. (Auth.)

14090. Khokhar, R. (Dept. of Zool., Bedford College, London N.W. 1, England). 1971. THE CHROMATIC PHYSIOLOGY OF THE CATFISH Ictalurus melas (Rafinesque) - I. THE MELANOPHORE RESPONSES OF INTACT AND EYELESS FISH. Comp. Biochem. Physiol., 39(3A): 531-543.

In the catfish Ictalurus melas the epidermal melanophores, compared with those of the upper and lower dermis, are the smallest, differ in shape, show slower pigment dispersion and more rapid aggregation and, when adapted to greys, less pigment dispersion. Black/white adaptation, at first rapid but later slow, requires 6-8 hr. The M.I. is approximately the same at darkness-equilibrium in intact and blinded catfish. The pigment in the latter is fully dispersed in illumination. I. melas occupies a position between teleosts with entirely or predominately neural chromatic control and those in which control is predominantly hormonal. (Auth.)

14091. Saddler, James B., and Rick Cardwell (Fish. Res. Inst., College of Fish., Univ. of Washington, Seattle, Washington). 1971. THE EFFECT OF TAGGING UPON THE FATTY ACID METABOLISM OF JUVENILE PINK SALMON. Comp. Biochem. Physiol., 39(4A): 709-721.

Wild juvenile pink salmon were captured at sea, tagged with a Dennison internal anchor tag and retained in sea water for 32 days. Mortality of tagged salmon was significantly higher than in untagged salmon. Liver lipid percentage increased from 5.9 percent in untagged salmon to 10.4 percent in tagged salmon and these changes were accompanied by diminutions in muscle weight and increases in liver weight. Extensive mobilization of specific fatty acids from muscle to liver tissues occurred in tagged salmon. These fatty acids were primarily of the mono-unsaturated and saturated types. (Authors)

14092. Umminger, Bruce L. (Dept. of Biol. Sci., Univ. of Cincinnati, Cincinnati, Ohio). 1971. CHEMICAL STUDIES OF COLD DEATH IN THE GULF KILLIFISH, Fundulus grandis. Comp. Biochem. Physiol., 39(4A): 625-632.

Serum chemistry was examined in saltwater-adapted Gulf killifish, Fundulus grandis, acclimated to 11, 4 and -1.5°C. Exposure of fish to -1.5°C caused cold death or coma in most fish within seven days, presumably due to osmotic imbalance. Exposure to -1.5°C was accompanied by a striking increase in serum osmolality and serum glucose, but by a decrease in serum sodium and chloride. Serum potassium was unchanged. The increase in serum osmolality in the cold was attributed to an accumulation of unknown organic substances. The reduction in serum electrolyte levels in the cold was thought to be an unsuccessful attempt to compensate for the elevation in serum osmolality caused by the buildup in serum organic constituents. (Auth.)

14093. Wood, Chris M., and D. J. Randall (Dept. of Zool., Univ. of Brit. Columbia, Vancouver 8, Brit. Columbia, Canada). 1971. THE EFFECT OF ANAEMIA ON ION EXCHANGE IN THE SOUTHERN FLOUNDER (Paralichthys lethostigma). Comp. Biochem. Physiol., 39(3A): 391-402.

Measurements of branchial sodium efflux rates, radiosodium spaces, and plasma ionic levels were made in southern flounder through use of a catheterization technique which permitted serial blood sampling. Disturbances in hematocrit and plasma sodium concentration were associated with the catheterization prodedure. Sodium efflux rate was reduced 23 percent in fish rendered anaemic through bleeding. Radiosodium spaces and plasma sodium and potassium levels were not significantly changed by anaemia. However, plasma sodium and potassium levels were positively correlated regardless of hematocrit. The results are discussed in terms of present theories of electrolyte balance and blood shunting mechanisms in the gills of teleosts. (Authors)

14094. Jearld, Ambrose, Jr., and Bradford E. Brown (Okla. Coop. Fish. Unit, Okla. State Univ., Stillwater, Oklahoma). 1971. FOOD OF THE CHANNEL CATFISH (Ictalurus punctatus) IN A SOUTHERN GREAT PLAINS RESERVOIR. Amer. Midl. Nat., 86(1): 110-115.

Stomach contents were examined of 196 channel catfish collected from October 1967 through August 1969. Insects, fish and detritus were most frequently found in the stomachs. Channel catfish smaller than 300 mm (total length) fed primarily on invertebrates. Larger fish were piscivorous. (Authors)

14095. Nyberg, Dennis Wayne (Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1971. PREY CAPTURE IN THE LARGEMOUTH BASS. Amer. Midl. Nat., 86(1): 128-144.

The behavior of the largemouth bass, Micropterus salmoides, during prey capture was studied with high-speed cinematography. Differences in the pattern of approach to prey indicated that the bass distinguished different types of prey and whether the prey was on the bottom or in mid-water. The distance from the prey at which the final attack was initiated was greater when the bass was traveling toward the prey at a higher velocity. The allowable error in this initiation distance was about one-fourth the length of the bass's head. Attacks initiated beyond this margin of error usually failed. About 10% of all filmed attacks failed. Once the jaws began to open the sequential movements of the head elements appeared to be completely determined. Two different patterns were observed, however, depending on whether the bass swam over the prey or drew the prey toward itself, i.e., suction feeding. Rationalization of these differences is presented. During suction feeding, the usual alternative, the jaws were opened before there was appreciable expansion of the mouth cavity. The asymmetry between opening and closing movements was also important; for without differences between them the prey would be expelled as the jaws closed. The additional velocity of the upper jaw due to protrusion of the premaxilla was measured. This additional velocity was relatively greater for smaller bass and in the slower-moving attacks of the same fish. The significance of this additional velocity in the evolution of the protrusible upper jaw of fishes is discussed. (Auth.)

14096. Orlowski, Stanley J., Hayden N. Pritchard, and Sidney S. Herman (Dept. of Biol., Lehigh Univ., Bethlehem, Pennsylvania). 1971. ACRYLAMIDE GEL AS AN EMBEDDING MATERIAL FOR TELEOST EGGS. Trans. Amer. Micros. Soc., 90(3): 369-372.

A method using acrylamide gel as an embedding material for fish eggs is described. Using this new procedure eggs retain their normal morphology, thus eliminating the gross morphological distortions encountered using standard histological methods. (Authors)

14097. Schwarz, Abby (Dept. of Zool., Univ. of Calif., Berkeley, California). 1971. SWIMBLADDER DEVELOPMENT AND FUNCTION IN THE HADDOCK, Melanogrammus aeglefinus L. Biol. Bull., 141(1): 176-188.

The swimbladder in the haddock appears on the 11th day of embryogenesis as a dorsal outgrowth of the gut just posterior to the liver diverticulum. In later stages its true position just anterior to the liver becomes visible. Swimbladder inflation occurs very soon after yolk sac absorption. At this time the larvae measure 4-4.5 mm and have begun feeding. Haddock larvae probably do not swallow air to fill their swimbladders. The initial gas volume may be derived from glycogenolysis, as glycogen is present in substantial amounts in uninflated swimbladder epithelium. Glycogen is absent from the paravascular portions of the epithelium in inflated swimbladders but is well-represented elsewhere in the cells. It is proposed that the inflated swimbladder in larvae less than 8.0 mm serves to decrease their density and thereby carry them up towards the level of the forming thermocline. By the time the thermocline is well-established, the larvae are larger and of greater swimming ability, and with the aid of a functioning swimbladder should be able to maintain themselves within it. (Auth. summ.)

14098. Wallace, Dale C. (Dept. of Biol., Eastern Michigan Univ., Ypsilanti, Michigan). 1971. THE AGE AND GROWTH OF THE SILVERJAW MINNOW, Ericymba buccata Cope. The Amer. Midl. Nat., 86(1): 116-127.

A study of the age and growth of Ericymba buccata Cope in Vigo Co., Indiana, was based on calculated increments of growth as well as length frequencies observed through the year. The annulus is a valid year mark. Annulus completion takes place over 2-1/2 to 3 months with older individuals completing the annulus later. Young-of-the-year continue growth later in the autumn and commence growth earlier the following spring than older fish. Growth compensation by later-hatched young is indicated. In their third summer of life males grow to a larger size than females. The maximum life span for this species is about 4 years. A poor year of growth in 1963-64 is apparently correlated with lower mean spring and summer air temperatures during that period. (Auth.)

14099. Woods, Carlene E. (Biol. Dept. Univ. of No. Dakota, Grand Forks, North Dakota). 1971. HELMINTH PARASITES OF FISHES FROM THE FOREST RIVER, NORTH DAKOTA. Amer. Midl. Nat., 86(1): 212-215.

Thirteen species of fishes were collected from the Forest River, N. D., during the summers of 1966, 1967 and 1968. All 140 fish were found to be infected with at least one parasitic trematode, cestode, acanthocephalan or nematode. Ten species of helminths were found to be new parasite records for North Dakota fishes. The helminths of this study were compared with those found in two previous North Dakota studies. (Auth.)

14100. Daly, James J., and Dominic L. DeGiusti (Dept. of Biol., Wayne State Univ., Detroit, Michigan). 1971. Trypanosoma catostomi n. sp. FROM THE WHITE SUCKER Catostomus c. commersoni (Lacépède). J. Protozool., 18(3): 414-417.

Trypanosoma catostomi n. sp. is described from the blood of the white sucker Catostomus c. commersoni (Lacépède) from southeastern Michigan. Two methods of fixation, wet and dry, are compared for their effect on body measurements. The type of fixation used affects the length of the free flagellum. Significance of this finding is discussed. (Authors synopsis)

14101. Vézina, R., and R. Desrochers (Service de la Faune, Ministere du Tourisme, de la Chasse et de la Peche, Quebec, Quebec, Canada). 1971. INCIDENCE OF Aeromonas hydrophila IN THE PERCH, Perca flavescens Mitchill. Canad. J. Microbiol., 17(8): 1101-1114.

Over a 4-month period, 450 perches (Perca flavescens) were captured in four lakes of the Eastern Townships, Quebec, and examined for the presence of Aeromonas hydrophila, the causative agent of hemorrhagic septicemia. This bacterium was present in 78 perches. One hundred and eight strains of Aeromonas hydrophila were isolated from the heart, liver, and kidneys of those fishes. The study of the water quality of the lakes has shown that there is no positive relation between pollution and the incidence of Aeromonas in the perches studied. (Authors)

14102. Sinha, V. R. P. (Trop. Fish. Cult. Res. Inst., Malacca, West Malaysia). 1971. INDUCED SPAWNING IN CARP WITH FRACTIONATED FISH PITUITARY EXTRACT. J. Fish Biol., 3(3): 263-272.

Three different fractions of fish pituitary extract obtained by molecular sieving of the whole pituitary extracts on Sephadex G-100 have been tested for effectiveness in inducing spawning of members of the carp family. Fish differing in their spawning habits were chosen - bighead carp and silver carp do not spawn at all in captivity, whereas Punctius and common carp spawn freely. Gravid fish injected with the second fraction alone showed courtship behaviour and ovulated viable eggs. None of the fish injected with the first fraction or the third fraction showed any courtship behaviour nor did they ovulate. The second fraction from the pituitary extract of free spawner or non-spawner, immature or mature, male or female was found effective in inducting spawning in both the free spawner and non-spawner gravid females. Clearly this suggested that this fraction contains either an active gonadotropin or a gonadotropin releasing factor. However, unlike the free spawner, these non-spawners do not breed in captivity unless injected with an additional amount of the second fraction or the whole pituitary material. The cause of this is still difficult to explain. Synthetic mammalian hormones such as FSH, LH, mixed mammalian anterior pituitary and chorionic hormone, ACTH and posterior pituitary hormones have failed to induce courtship behaviour and ovulation. Oxytocic activity of the fractions showed that there was no correlation between spawning activity and the rat uterus activity. Also these fractions did not contain any appreciable amount of arginine vasotocin. Thus it is suggested that isotocin/arginine vasotocin is not the principle responsible for spawning in these fish. (Auth.)

14103. Bolis, L., P. Luly, and V. Baroncelli (Istituto di Fisiologia Generale, Universita di Roma, Rome, Italy). 1971. D(+)-GLUCOSE PERMEABILITY IN BROWN TROUT Salmo trutta L. ERYTHROCYTES. J. Fish Biol., 3(3): 273-275.

D(+)-Glucose penetration in trout erythrocytes was studied with osmotic and tracer methods. Results give no evidence for a carrier mediated diffusion system like that concerned with glucose permeability as in human red cells. The data show that glucose fails to stimulate erythrocyte respiration. (Authors)

14104. Haram, O. J., and J. W. Jones (Dept. of Zool., Univ. of Liverpool, England). 1971. SOME OBSERVATIONS ON THE FOOD OF THE GWYNIAD Coregonus clupeoides pennantii Valenciennes OF LLYN TEGID (LAKE BALA), NORTH WALES. J. Fish Biol., 3(3): 287-295.

The seasonal variations in the diet of adult gwyniad Coregonus clupeoides pennantii=C. lavaretus from Llyn Tegid, North Wales were studied. Stomachs were examined to determine fullness, volume and identity of contents. A clear seasonal cycle in food intake was found. Feeding rates were low from January to April but increased during the summer (May-June) and remained at a high level until December. The period of low feeding intensity coincided with the time of spawning and the time of annulus formation of both scales and otoliths. The diet showed seasonal changes and two main periods were distinguished; December to July, when the fish fed mainly on bottom fauna, and August to November, when the diet included both bottom fauna and midwater and surface foods. The gwyniad were shown to be opportunistic in feeding, the composition of the diet reflecting availability of food items rather than selective feeding on the part of the fish. (Authors)

14105. Crossland, N. O., A. J. A. Pearson, and M. S. Bennett (Shell Research Ltd., Woodstock Agric. Res. Centre, Sittingbourne, Kent, England). 1971. A FIELD TRIAL WITH THE MOLLUSCICIDE FRESCON FOR CONTROL OF Lymnaea peregra Müller, SNAIL HOST OF Diplostomum spathaceum (Rudolphi). J. Fish Biol., 3(3): 297-302.

Larval stages of the parasite Diplostomum spathaceum cause blindness in rainbow trout Salmo gairdneri (Richardson). The adult parasite is found in the intestine of various species of gulls, and larval stages are found in various species of snails belonging to the genus Lymnaea. A field trial was carried out at Lodge Reservoir, near Chelmsford Essex to test the effectiveness of chemical control of the snail Lymnaea peregra. The molluscicide, Frescon, was applied in the first instance to the whole of the reservoir to give a concentration of 0.025 p.p.m. in the water using a motorized applicator mounted at the rear of a small boat. A second treatment was carried out when only the periphery of the lake was sprayed to a distance of 5 m from the banks to give a concentration of 0.1 p.p.m. No L. peregra were found in samples taken 10 days after the second application of Frescon and it is concluded that this snail had been virtually eliminated from the reservoir. No mortality of trout was observed. Some of the sticklebacks Gasterosteus aculeatus L. were killed and this may be attributable to uneven distribution of molluscicide near the margin of the reservoir. There were no apparent side-effects on aquatic invertebrates or other wild life. Five months after treatment some repopulation of the shoreline by L. peregra was observed, and applications of Frescon may therefore need to be repeated on several occasions during the season to maintain an effective level of control. However, where snail pests are confined mainly to the margin of such bodies of water, peripheral treatment may be effective and would be relatively inexpensive. (Authors)

14106. Templeton, R. G. (Yorkshire Ouse and Hull River Auth., 21 Park Square South, Leeds, England). 1971. AN INVESTIGATION OF THE ADVANTAGES OF AUTUMN AND SPRING STOCKING WITH BROWN TROUT Salmo trutta L. IN A YORKSHIRE RESERVOIR. J. Fish Biol., 3(3): 303-324.

Batches of trout have been introduced into Chelker Reservoir in Yorkshire in the autumn and spring since the 1870's for angling purposes. Six batches of tagged, hatchery-reared brown trout Salmo trutta L. were introduced from autumn 1966 to spring 1969. During the angling season fish introduced in the spring give better catches than those stocked in the autumn. At the beginning of the season the larger fish in the spring batch are caught more often than the smaller fish from the same batch. The larger fish in the autumn batch are caught more often than the smaller fish from that batch throughout the season. The population, available to the angler from the shore was estimated to be 1491 in 1968, with 722 fish/km of shoreline. More fish survive to a second year in the reservoir than is apparent from the number of tags returned. Fish introduced in the spring usually begin growing before those introduced in the autumn, thereafter growth rates varied. The growth rate was independent of the number of fish stocked up to the numbers put in. Batches of tagged trout were retained at the hatchery up to nine months to gain relevant experience of post-tagging mortalities, tag loss rate and effect of tags on growth. (Auth.)

14107. Payne, A. I. (Fourah Bay Coll., Univ. of Sierra Leone, Freetown, Sierra Leone, Africa). 1971. AN EXPERIMENT ON THE CULTURE OF Tilapia esculenta (Graham) AND Tilapia zillii (Gervais) (CICHLIDAE) IN FISH PONDS. J. Fish Biol., 3(3): 325-340.

Segregated populations of Tilapia zillii and Tilapia esculenta were kept in artificial ponds. Supplementary food was given and phytoplankton was encouraged by the addition of superphosphate and ammonium sulphate fertilisers. The fry were cropped regularly in an attempt to control population size. A control population of T. zillii was also established in which none of these procedures were carried out. The growth of T. esculenta was found to be dependent upon the phytoplankton density of the pond whilst T. zillii successfully utilized the supplementary food and grew well. The T. esculenta population also produced more fry than the T. zillii

population. The comparative advantages of planktivorous/brooders and herbivorous/guarders in fish culture are considered. Despite the fecundity of the species used a population of known composition was maintained by manual cropping of the fry. The addition of ammonium sulphate to the ponds caused blooms of phytoplankton which in turn had effects upon the base reserves and pH of the water, and probably caused some reduction of oxygen concentration beneath surface scums. This last point is used to explain the changes in phosphate and calcium content of the water also observed. The low oxygen concentration frequently noted in the mornings probably affected the feeding behaviour of the fishes, and was low enough to have affected metabolism directly. (Auth.)

14108. Dembinski, W. (Dept. of Fishing Technique, Inland Fish. Inst., Olsztyn, Poland). 1971. VERTICAL DISTRIBUTION OF VENDACE Coregonus albula L. AND OTHER PELAGIC FISH SPECIES IN SOME POLISH LAKES. J. Fish Biol., 3(3): 341-357.

Studies on the vertical distribution of vendace Coregonus albula (L.), smelt Osmerus eperlanus (L.) and bleak Alburnus alburnus (L.) in lakes have been carried out with the application of an echo sounder and then compared with control catches of fish and plankton. Methods and results have been discussed. Some remarks have been made on taking these species of fish. (Auth.)

14109. Cushing, D. H. (Fish. Lab., Lowestoft, Suffolk, England). 1971. THE DEPENDENCE OF RECRUITMENT ON PARENT STOCK IN DIFFERENT GROUPS OF FISHES. J. Cons., 33(3): 340-362.

An attempt was made to establish differences between groups of fishes in the nature of their stock and recruitment curves. Recruitment in logarithms was plotted on stock in logarithms and the slope was used as an index of density dependence. A number of stocks of Pacific salmon, Atlantic herring, Pacific herring, flatfish and gadoids were examined. It was found that the index of density dependence was inversely correlated with the cube root of the fecundity, which implies that for stocks of the same size, the distance apart of the larvae plays an important part in the determination of density dependence. Four pelagic stocks, Hokkaido herring, Norwegian herring, Japanese sardine and Californian sardine, were examined. The stocks collapsed when fishing effort was high, and it was suggested that in two cases Ricker's limiting value of the exploitation rate might have been reached. (Auth.)

14110. Hislop, J. R. G., and C. C. Hemmings (Marine Lab., Aberdeen, Scotland). 1971. OBSERVATIONS BY DIVERS ON THE SURVIVAL OF TAGGED AND UNTAGGED HADDOCK Melanogrammus aeglefinus (L.) AFTER CAPTURE BY TRAWL OR DANISH SEINE NET. J. Cons., 33(3): 428-437.

The physiological factors affecting the survival of demersal fish caught by trawl and Danish seine were considered in relation to initial tagging mortality. Experiments using haddock that were confined in sea-bed cages showed that the initial mortality was greater when the fish had been taken to the surface after capture than when they were transferred directly from the codend to a sea-bed cage. It is probable that the main factors responsible for causing initial mortality in those fish that had been taken to the surface were physiological shock and fatigue together with swimbladder damage; together these factors rendered the fish extremely vulnerable to any adverse environmental conditions when they were returned to the sea-bed. Tagging itself was considered to be a comparatively minor contributant to initial mortality. (Authors)

14111. Greig, R. A., and R. H. Gnaedinger (NMFS, Technological Lab., Ann Arbor, Michigan). 1971. OCCURRENCE OF THIAMINASE IN SOME COMMON AQUATIC ANIMALS OF THE UNITED STATES AND CANADA. U. S. Dept. of Comm., NOAA, NMFS., Special Scientific Report - Fisheries No. 631, 7 p.

Two tables are presented that survey the presence or absence of thiaminase in freshwater and marine fish and shellfish. (Authors)

14112. Esch, Gerald W. (Dept. of Biol., Wake Forest Univ., Winston-Salem, North Carolina). 1971. IMPACT OF ECOLOGICAL SUCCESSION ON THE PARASITE FAUNA IN CENTRARCHIDS FROM OLIGOTROPHIC AND EUTROPHIC ECOSYSTEMS. Amer. Midl. Nat., 86(1): 160-168.

Approximately 30 species of larval and adult parasites were collected from 549 centrarchid fish and 7718 gastropod molluscs from an oligotrophic and two eutrophic lakes in southwestern Michigan. The distribution pattern indicates that centrarchids from the oligotrophic lake harbor a wide range of species of adult parasites and a comparatively smaller number of larval forms, many of which complete their life cycles in predatory fish. On the other hand, bass and sunfish from the two eutrophic lakes harbor a proportionately larger number of larval parasites, most of which culminate their life cycles in fish-eating birds and mammals. A trophic hypothesis, based on the nature of predator-prey relationships in each of the two types of ecosystem, is proposed to explain the distribution patterns of parasites. (Auth.)

14113. Gerking, Shelby D. (Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1971. INFLUENCE OF RATE OF FEEDING AND BODY WEIGHT ON PROTEIN METABOLISM OF BLUEGILL SUNFISH. Physiol. Zool., 44(1): 9-19.

The research was directed at the general problem of fish production where growth is of primary concern. Growth of the bluegill sunfish (Lepomis macrochirus) of different sizes was determined by feeding larvae of Tenebrio molitor (mealworms) at various rates in laboratory aquaria. Growth was defined as protein accumulation, and a nitrogen balance method was used to partition the food intake into its various uses. A total of 59 specimens of weights averaging 13.9, 27.0, 41.3, 68.9, and 85.2 g were fed from 20 to 30 days in individual aquaria. Most of the fish were taken from three lakes in northern Indiana; one series was collected in the southern part of the state. With the exception of one series, the aquaria were kept in a temperature controlled room at 24.5 C with 12 hours of light. The mealworms, a group of sample fish at the beginning of the feeding period, and the experimental fish at the end of the period were analyzed for nitrogen content with the micro-Kjeldahl apparatus. Each of the five experiments yielded a linear relation between nitrogen retained and nitrogen consumed, expressed in milligrams of N per day. This relation held for fish fed both above- and below-maintenance rations. A progressive reduction in the rate of nitrogen retention in relation to nitrogen consumption occurred as weight increased. An analysis of variance indicated that the regression coefficients differed significantly among themselves, implying an influence of size on the gross efficiency of protein utilization for growth. Size also influenced the partial (net) growth efficiency measured as protein. The amount of nitrogen required to maintain equilibrium under the conditions of the experiment was measured as the x-intercept of the regression. Maintenance nitrogen increased as weight increased, with one exception. The y-intercept - the point of endogenous nitrogen excretion - followed the same general trend as did the x-intercept. Variation in the rate of nitrogen retention for a given consumption rate was greater than desirable and was attributed to the inability of obtaining experimental animals from a constant source with the same nutritional history. The present results are compared in detail with those that have appeared in the literature. (Auth. summ.)

14114. Reichenbach-Klinke, Heinz-Hermann. 1970. THE MAIN COMMERCIAL FISHES OF THE DANUBE AND THEIR SUPPOSED DISTRIBUTION. (Die wichtigsten Nutzfischarten der Donau und ihre mutmassliche Verteilung). Arch. Hydrobiol. / Suppl. 36(2/3): 263-278, Stuttgart. (In German).

About 4.4 million kg of fish are caught annually in the Danube. An attempt is made to show how this catch is distributed by individual species. Nine diagrams are presented for the entire 2,825 km reach of the Danube; they mediate the portions of the fish species in the total catch at average low water. From the source to the mouth the predominant representatives are: trout, barbels, nases,breams, carps, pikeperch, European catfish, northern pike, sturgeons and herrings. The cyprinids are of primary economic importance in the Danube above Eisernen Tors, and sturgeons and Danube herrings below, as well as pikeperch, pike and European catfish below Vienna. -- Robert M. Howland

14115. Umminger, Bruce L. (Dept. of Biol. Sci., Univ. of Cincinnati, Cincinnati, Ohio). 1971. PATTERNS OF OSMOREGULATION IN FRESHWATER FISHES AT TEMPERATURES NEAR FREEZING. Physiol. Zool., 44(1): 20-27.

In virtually all freshwater fish studied, serum inorganic ions decrease in the cold. The response of serum osmolality to this reduction in electrolytes follows one of four patterns in freshwater fish: No compensation: Serum osmolality decreases to the same extent as serum electrolytes; no organic substances are added to the serum in the cold to compensate for the reduction in osmolality. The brown bullhead Ictalurus nebolusus displays this pattern. Partial compensation: Serum osmolality decreases in the cold, but to a lesser extent than the decrease in serum electrolytes; organic substances are increased in the serum in the cold to partially compensate for the decrease in electrolytes. However, the amount of organic substances added to the serum in the cold is not sufficient to raise the osmolality to the levels of warm-acclimated fish. The killifish Fundulus heteroclitus (adapted to fresh water) shows this pattern. Perfect compensation: Serum osmolality remains unchanged in the cold, despite a decrease in serum electrolytes; organic substances are added to the serum in quantities sufficient to fully compensate for the reduction in electrolytes. The carp, Cyprinus carpio, responds with this pattern. Overcompensation: Serum osmolality increases in the cold, despite a decrease in serum electrolytes; organic substances are added to the serum in the cold in quantities sufficient to elevate the osmolality above the levels in warm-acclimated fish. No fish has yet been found to display this pattern; at present, it is only a theoretical possibility. (Auth. summ.)

14116. Reynolds, Julian D. (Volta Basin Research Project, Univ. of Ghana, Legon, Ghana, Africa). 1971. BIOLOGY OF THE SMALL PELAGIC FISHES IN THE NEW VOLTA LAKE IN GHANA. II. SCHOOLING AND MIGRATIONS. Hydrobiologia, 38(1): 79-91.

Five species of small pelagic fishes in the new Volta Lake in Ghana showed a diel periodicity in catches, and were strongly attracted to light. As these forms occur typically in rivers, their school formation and migratory movements were investigated, and their purposes are discussed. It appears that a diel vertical movement occurs so that the fish can exploit a feeding ground at its richest moments, and at times when they are least conspicuous to predators. The school is the normal method of migrating, as it confers protection against predators. Once the fish cease to move, however, the school loses its coherence and its individuals disperse. Indirect evidence is also presented that in three species a longitudinal upstream migration may occur, probably to breed after the rains, and in two others, there may be a lateral movement into prevailing winds. (Auth. summ.)

14117. Bohl, Martin. 1971. AERATION OF CARP WINTERINGS AT CRITICAL TIMES (Belüftung von Karpfenwinterungen in kritischen Zeiten). From the Wielenbach Pond Culture Div. of the Bavarian Biol. Res. Inst. at Munich; Reprint from: Sonderdruck aus "Der Fischbauer" No. 2, 2 p. In German.

The successful installation of an aerating device in a critical phase of carp wintering is reported, with which in addition to the oxygenation the area around the outflow was kept ice-free. -- Robert M. Howland

14118. Srivastava, V. M.. 1971. FISH OF THE GULF OF ST. LAWRENCE. AN UNABRIDGED BIBLIOGRAPHY. Fish. Res. Bd. Canada Tech. Rep. No. 261, 141 p.

The object of the bibliography was to compile a list of all work done on Gulf of St. Lawrence fish. The references are indexed under the scientific name of the fish, using the name given by Leim and Scott (1966). Included with the Gulf of St. Lawrence are the St. Lawrence estuary to Quebec City, Saguenay fjord, the Strait of Belle Isle, and Cabot Strait west of a line from Hermitage Bay to the northern tip of Cape Breton. This area includes some water of low salinity and so some freshwater species are included from these brackish waters. (From auth. introduction)

14119. Gulland, J. A. (FAO, Fish. Dept., Rome, Italy). 1971. SCIENCE AND FISHERY MANAGEMENT. J. Cons., 33(3): 471-477.

Modern fisheries are changing and developing so rapidly that the traditional procedures for the scientific assessment of the stock and for the implementation of management measures are no longer entirely appropriate. Management authorities should be prepared to take early action, and usually cannot afford to wait for complete scientific evidence. Equally the scientific community must be prepared to give early advice even when the data are very scanty. At the same time arrangements should be made to continually revise the advice as new data become available. (Auth.)

14120. Druzhinin, A. D. (All-Union Res. Inst. for Sea Fish. and Oceanog. (VNIRO), Moscow). 1970. THE RANGE AND BIOLOGY OF SNAPPERS (FAM. LUTJANIDAE). Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 717-736.

An account is given of data on the range of species and genera of the family Lutjanidae in the waters of the oceans of the world. It is concluded from an analysis of distribution features that this family is of Indo-West Pacific origin. Data are given concerning the vertical range of snappers, their length, weight, age, spawning period, fecundity and the composition of their food.

14121. Putina, Ye. P., L. S. Fedorova, E. A. Savel'yeva, and A. L. Arakelova (Azov Fish. Res. Inst. (AzNIIRKh), Rostov-on-Don, USSR). 1970. THE EFFECT OF FRACTIONAL INJECTIONS OF PITUITARY SUSPENSION ON MATURATION OF THE SEXUAL PRODUCTS OF FEMALE PIKE-PERCH. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 743-754.

The effect of fractionally injected pituitary suspension on the duration of maturation and the quality of the eggs obtained has been studied in the example of the Don Pike-perch spawning at different times. Special features of the oocytes of females which fail to yield eggs have been established, in addition to features of the growth and stage of maturity of the eggs throughout the entire experiment. Histological and biochemical analysis were performed with a comparison of the results.

14122. Chigirinskiy, A. I. (Pacific Res. Inst. for Sea Fish. and Oceanog. (TINRO), Vladivostok, USSR). 1970. THE NATURE OF OOGENESIS AND FECUNDITY IN THE JAPANESE HORSEMACKEREL [Trachurus japonicus (Temminck et Schlegel)]. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 755-760.

Histological analysis of the ovaries of 20 Japanese horsemackerel caught in spring 1968 in the East China Sea has shown that this species is one of the fishes in which there is asynchronous growth of the oocytes leading to the spawning of three series of eggs. The first batch is the largest and comprises on average 70% of the total quantity of eggs which should be laid in the coming spawning season. The fecundity of Japanese horsemackerel measuring 22-40 cm is 250 thousand eggs, provided that all the egg batches are laid.

14123. Krivobok, M. N., and A. Ya. Storozhuk (All-Union Res. Inst. for Sea Fish. and Oceanog. (VNIRO), Moscow, USSR). 1970. THE EFFECT OF THE SIZE AND AGE OF VOLGA STURGEON ON THE WEIGHT AND CHEMICAL COMPOSITION OF MATURE EGGS. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 761-765.

Differences in the quality of mature eggs of the Volga sturgeon are due to the age and size of the females. The eggs of young females are the smallest and contain the least percentage of dry matter, lipid and total nitrogen. As the age and size of a fish increase the weight of the eggs initially increases, but decreases once again in the oldest and largest fish. The content of dry matter, lipid and total nitrogen in the eggs increases with the age and is maximum in the oldest and largest fish.

14124. Kuznetsov, V. A. (Dept. of Vertebrate Zool., Kazan State Univ., USSR). 1970. SPAWNING GROUNDS OF SOME PERCID FISHES IN SVIYAGA BAY, KUYBYSHEV RESERVOIR, THE DISTRIBUTION OF LARVAE AND THE EFFECTIVENESS OF REPRODUCTION. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 765-771.

Under the conditions of Sviyaga Bay in Kuybyshev Reservoir the pike-perch, Volga pike-perch, perch and pope have adapted themselves to spawning in open areas, in regions where there are submerged shrubs and make considerably less use of the littoral areas. As a result the effectiveness of their reproduction is relatively high and is not subject to sharp fluctuations in relation to water-level regime. A reciprocal correlation has been noted in the perch between the quantity of young and water level: in years when water level in the spring is low the yield of young is higher than when there is an excess of water in the spring. A high survival rate of percid larvae is also promoted by the fact that they begin to migrate into the inshore area only in stage D_2 and remain less closely aggregated.

14125. Shatunovskiy, M. I. (Moscow State Univ. and All-Union Res. Inst. for Sea Fish. and Oceanog. (VNIRO), Moscow, USSR). 1970. FEATURES OF THE QUALITATIVE COMPOSITION OF LIPIDS IN THE EGGS, YOUNG AND SPAWNING FEMALES OF THE SPRING AND AUTUMN BALTIC HERRING IN THE GULF OF RIGA. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 772-779.

An account is given of the results of a study of the fractional composition of total lipids and the fatty acid composition of neutral lipids in the eggs, young and spawners of the autumn and spring Baltic herring. Preliminary results have been obtained in electrophoretic analysis of blood serum proteins of the spawning Baltic herring. It has been found that specimens of young and spawners of the autumn Baltic herring contain relatively and absolutely more phospholipids, triglycerides and unsaturated fatty acids than spring Baltic herring of the same ages. The mature eggs of the autumn Baltic herring also contain relatively more highly unsaturated fatty acids than those of the spring Baltic herring. The features noted in the lipid metabolism of fishes of both Baltic herring races are related to differences in the temperature regimes associated with their life history.

14126. Kudrinskaya, O. M. (Inst. of Hydrobiol., Ukrainian Academy of Sciences, Kiev, USSR). 1970. FOOD AND TEMPERATURE AS FACTORS AFFECTING THE GROWTH, DEVELOPMENT AND SURVIVAL OF PIKE-PERCH AND PERCH LARVAE. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 779-788.

A study has been made of the effect of temperature and of different zooplankton concentrations on the food consumption, growth, development and survival of pike-perch and perch larvae. It has been established that different feeding conditions affect the growth and development of the larvae only at optimum temperatures. When water temperature is reduced to 16.0°C not only is there a sharp reduction in food consumption, but there is also a change in the distribution of its assimilated part, a larger proportion of which is expended on metabolism, and as a result the growth rate falls sharply. The amount of mortality of the larvae related to the effect of the food factor (40%) corresponds to the number of larvae not supplied with the minimum ration, producing the energy needed only for expenditure on metabolism.

14127. Ivanov, V. N. (Inst. of the Biol. of the Southern Seas, Ukrainian Academy of Sciences, Sevastopol', USSR). 1970. CONCENTRATION OF ZINC-65 BY THE EGGS OF THE BLACK SEA TURBOT [Scophthalmus maeoticus maeoticus (Pallas)]. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 863-865.

Developing Black Sea turbot eggs are capable of concentrating zinc-65 from the surrounding environment. The rate of zinc-65 concentration alters in the course of embryonic development. Radiozinc is concentrated at the greatest rate during the period of early embryogeny.

14128. Belyy, N. D. (Inst. of Hydrobiol., Ukrainian Academy of Sciences, Kiev, USSR). 1970. THE BIOLOGY OF EARLY DEVELOPMENT STAGES OF THE BREAM UNDER DEEP-WATER CONDITIONS. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 789-796.

Observations which have been carried out show that the biological features of bream embryos and larvae developing at great depths are slightly different from the features of bream developing in shallow water. Long before gas appears in the swimbladder free embryos of the bream tend to rise in the water, where they are found in a floating state. When gas appears in the swimbladder free bream embryos hatched in deep water forsake the middle and bottom water layers and keep to the surface layer. The survival of free bream embryos developing at great depths may reach 100%. Development of the bream in the early stages proceeds normally under deep water conditions.

14129. Podushko, M. V. (Amur Dept., Pacific Res. Inst. for Sea Fish. and Oceanog. (TINRO), Khabarovsk, USSR). 1970. THE FEATURES OF SCALE GROWTH AND REPEAT SPAWNING OF THE AMUR WHITEFISH (Coregonus ussuriensis Berg). Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 797-803.

An investigation has been made of the features of scale growth in the Amur whitefish and of the formation of the annuli, which may have the significance of a 'spawning mark'. Data are given concerning the duration of the sexually mature period in the life of the fish, the size-age composition of the spawning stocks, and growth rate. It is shown that there is a level of post-spawning exhaustion which may be the cause of the death of these fish during the long harsh winter.

14130. Reshetnikov, Yu. S., L. P. Paranyushkina, and V. I. Kiyashko (A. N. Servertsov Inst. of Evolutionary Morphology and Animal Ecology, USSR Acad. of Sci. (IÉMÉZh), Moscow, and Dept. of Ichthyology, Moscow Univ., USSR). 1970. SEASONAL CHANGES OF BLOOD SERUM PROTEIN COMPOSITION AND FAT CONTENT IN WHITEFISHES. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 804-815.

A detailed analysis is made of changes in the percentage proportion of protein fractions of the blood serum, of alteration in total fat content and of lipid distribution by individual organs in Lake Chun (Murmansk Province) whitefishes in the summer and fall in connection with the feeding, growth and maturation of the fishes. The onset of sexual maturity in whitefishes is connected not only with the attainment of a definite size and age by the fish, but also with the attainment of a definite level of fat reserves specific to each population. It is shown that redistribution of lipid in the body of the fish takes place from the commencement of intensive growth of the gonads and that cavity fat is the first to be expended, followed by muscle fat. A large quantity of lipids appears simultaneously in the blood of maturing males and females. A new lipoprotein having the same electrophoretic mobility as the β globulin fraction is noted in the blood of maturing females in stage III - IV of maturity. An analysis is made of the role of the liver during maturation of the sexual products in whitefish. In maturing females the increase in the weight of the gonads, the increase in the proportion of β globulins in the blood and the appearance of a new lipoprotein are connected with an increase in the weight of the liver and with an increase in its functional activity. There is a connection between the large energy expenditure during the spawning of whitefish and the fact that some individuals are obliged to miss a spawning season.

14131. Tugarina, P. Ya., and L. N. Ryzhova (Dept. of Vertebrate Zool., Irkutsk State Univ., USSR). 1970. SEASONAL CHANGES IN THE BLOOD OF THE BLACK BAIKAL GRAYLING [Thymallus arcticus baicalensis (Dyb.)]. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 816-826.

A study has been made of seasonal and sexual variability of the blood of the black Baikal grayling. Observations were made on maximum hemoglobin concentration and on the number and volume of erythrocytes in May-November. These quantities reach their maximum in grayling spawners during the spawning period. The minimum concentration of hemoglobin and erythrocytes was noted in the

period spent beneath the ice. The blood characteristics of males are higher than those of females in all age groups. The composition of red blood cells of grayling females and males in the period spent under the ice and in the spawning period is stable. The composition of white blood cells of grayling males and females varies slightly by season. Lymphocytes predominate among the white blood cells. It is only during the spawning period and after spawning that a reduction of lymphocytes and an increase of monocytes and polymorphonuclear leukocytes is noted in the leukocytic formula of grayling spawners. Seasonal changes have been discovered in the size of the erythrocytes in grayling males and females.

14132. Solyus, A. A., D. G. Fleyshman, and V. G. Leont'yev (Lab. of Natural Radioactivity, I. M. Sechenov Inst. of Evolutionary Physiol. and Biochem., Leningrad, USSR). 1970. Cs^{137} CONCENTRATION BY THE FISHES OF FRESHWATER LAKES. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 827-832.

Caesium-137 concentrations were determined in fishes from some lakes in the Northwestern European territory of the USSR. Differences attaining values of two orders were found between fishes inhabiting different lakes; the highest caesium-137 concentrations were noted in fishes from lakes with a low potassium concentration in the water (less than 1 mg/liter). Within a single body of water caesium-137 concentrations were usually several times higher in members of the higher trophic levels than in fishes feeding plankton or benthos. Consideration is given to the question of the interrelationship between potassium concentration in a body of water and caesium-137 content in fishes.

14133. Popova, A. A. (All-Union Pond Fish. Res. Inst. (VNIIPRKh), USSR). 1970. VARIABILITY OF THE SWIMBLADDER IN CARP [Cyprinus carpio (L.)] FROM THE KURSK AND NIVA FISH FARMS. Journal of Ichthyology, published by the Amer. Fish. Soc., 10(6): 844-849.

Clear differences have been established in the ratio of the chambers and the relative length of the swimbladder in two strains of pond carp: pure pond carp and hybrid with a high proportion of inheritance from the eastern (Amur) wild carp. Kursk (hybrid) pond carp differ from Niva carp in the greater relative length of the swimbladder and the longer posterior chamber. Niva carp are characterized by higher variability indices of the relative length of the swimbladder and its posterior chamber, which is a result of the greater exposure of the swimbladder of the Niva carp to the effect of environmental conditions. The swimbladder (its relative length and the ratio of the chambers) is an important character which may and should find use in fish breeding research and, in particular, in the diagnosis of inheritance from the eastern (Amur) wild carp. The possibility of making use of this character for diagnosis of inheritance from the Volga wild carp must be established by further research. The relative length index of the posterior chamber provides the best characteristic of breed differences, since the effect of conditions on the variability of this character is traced only to a weak degree in the carp investigated. The swimbladder cannot be used as a character in breeding before the carp reaches an age of 1 year. Only groups of fishes of the same size may be compared, since the ratio of the chambers is subject to age variations.

14134. Il'yenko, A. I. (A. N. Severtsov Inst. of Evolutionary Morphology and Animal Ecology, USSR Academy of Sci., Moscow, USSR). 1970. CONCENTRATION OF STRONTIUM-90 AND CAESIUM-137 BY FRESHWATER FISHES. Journal of Ichthyology, published by Amer. Fish. Soc., 10(6): 860-862.

The present paper is devoted to a study of features of the movement of artificial radioisotopes from the food into the body of different fish species under natural environmental conditions. The food of the fishes considerably exceeds their content (usually by more than 100 times) in the water of the natural body of water. It may therefore be considered that the bulk of the radioisotopes enters the fish body from the food and not from the surrounding environment through the integuments of the body. Strontium-90 concentration in the skeleton of non-predatory fishes exceeds the content of this isotope in the food. Conversely, the amount of caesium-137 in the body of these fishes is lower than the amount in the food. In accordance with

this feature the concentration factor of strontium-90 exceeds unity in its transfer from food to the body of non-predatory fishes, and for caesium-137 it is considerably less than unity. Consequently, strontium-90 concentration is increased in this link of the food chain and caesium-137 concentration is reduced by comparison with the preceding trophic level. In the transfer of radioisotopes in the next link of the food chain (from the prey to the body of a predatory fish) different features are observed. The concentration of strontium-90 and caesium-137 is increased in the skeleton and muscles of large perch and pike, which feed exclusively on roach, by comparison with the content of these radioisotopes in the prey. In this case the concentration factors exceed unity, i.e. there is an increase of strontium-90 and caesium-137 concentration in this link of the food chain.

14135. Bjornn, T. C. (Idaho Coop. Fish. Unit, Univ. of Idaho, Moscow, Idaho). 1971. TROUT AND SALMON MOVEMENTS IN TWO IDAHO STREAMS AS RELATED TO TEMPERATURE, FOOD, STREAM FLOW, COVER, AND POPULATION DENSITY. Trans. Amer. Fish. Soc., 100(3): 423-438.

Many juvenile salmon and trout migrated from the Lemhi River drainage each fall-winter-spring period. Seaward migration of anadromous trout and salmon normally occurred in the spring but pre-smolt anadromous and non-anadromous fishes also left the stream usually beginning in the fall. I compared data on temperature, food abundance, stream flow, cover and population density with movements and conducted field and laboratory tests to determine reasons for the two types of movements. Smolts of the anadromous species migrated for an obvious reason but none of the factors I examined appeared to "stimulate or release" their seaward migration. Movement frequently coincided with changes in water temperature and stream flow, but I could not establish a consistent causal relationship and concluded that photoperiod and perhaps growth must initiate the physiological and behavioral changes associated with seaward migration. Non-anadromous and pre-smolt anadromous species emigrated from the streams for different reasons than the smolts. I postulated that fish found the stream environment unsuitable during the winter. Stream temperature declined in the fall as fish began moving from the streams but I could not induce more fish to stay in test troughs with 12 C water versus troughs with 0-10 C water. Fish emigrated before abundance of drift insects declined in winter. Emigration occurred in spite of the relatively stable flows in both streams. Population density modified the basic migration pattern by regulating the number and percentage of fish that emigrated and to a limited extent time of emigration. Movements of non-smolt trout and salmon correlated best with the amount of cover provided by large rubble substrate. Subyearling trout emigrated from Big Springs Creek which contained no rubble substrate but remained in the Lemhi River which did. In both field and laboratory tests more fish remained in troughs or stream sections with large rubble substrate than in troughs or sections with gravel substrate. Trout and salmon in many Idaho streams enter the substrate when stream temperatures declined to 4-6 C. A suitable substrate providing adequate interstices appears necessary or the fish leave. (Auth.)

14136. Jensen, A. L. (Environmental Biol. Branch, Div. of Environmental Res. and Development, Tenn. Valley Authority, Muscle Shoals, Alabama). 1971. THE EFFECT OF INCREASED MORTALITY ON THE YOUNG IN A POPULATION OF BROOK TROUT, A THEORETICAL ANALYSIS. Trans. Amer. Fish. Soc., 100(3): 456-459.

The effect on yield of increasing the mortality of the 0 age group by 0%, 5%, 15%, 25%, 50%, and 95% of the natural mortality is examined using a mathematical model for yield fitted to data on the Hunt Creek, Michigan, brook trout population. This analysis shows that even a 5% increase in mortality of the 0 age group, the lowest level examined, decreased the yield of the trout fishery. With 50% additional mortality the population became extinct, even though the effect of the toxicant did not become apparent for several years. (Auth.)

14137. Marquette, Willman M., and Clifford W. Long (NMFS, Biol. Lab., 2725 Montlake Blvd. East, Seattle, Washington). 1971. LABORATORY STUDIES OF SCREENS FOR DIVERTING JUVENILE SALMON AND TROUT FROM TURBINE INTAKES. Trans. Amer. Fish. Soc., 100(3): 439-447.

Fish-guiding screens of different porosities were tested with juvenile spring chinook salmon (Oncorhynchus tshawytscha) in a laboratory model that simulated a turbine intake and gatewell (a vertical shaft in a dam that extends from the forebay deck to the ceiling of the intake). The study was part of a program to develop methods for preventing mortality of juvenile salmon and steelhead trout (Salmo gairdneri) in Kaplan turbines of low-head dams on the Columbia and Snake Rivers. If large numbers of juvenile fish could be guided into gatewells, a method of safely bypassing them around turbines might be devised. Three types of screens (wood, and single and double layers of spiral-weave conveyor belt) were attached to the intake ceiling at an angle of 45° to the flow; their lengths were adjusted to intercept one-third or two-thirds of the total flow into the intake. The screen with the greatest porosity (constructed of a single layer of belting) gave the highest guiding efficiency; 87% of the test fish were diverted into the gatewell. We believed that water deflected under the screen carried fish with it, but our tests indicated that some fish swam upwards out of the flow and into the gatewell. Diversion of 3% of the intake flow up through a gatewell with a single opening into the intake increased the guiding efficiency of only the double-layer screen. Diversion of flow through a gatewell with two openings caused a significant percentage of the guided fish to leave the gatewell and reenter the intake. (Authors)

14138. Slatick, Emil (NMFS, Biol. Lab., 2725 Montlake Blvd. East, Seattle, Washington). 1971. PASSAGE OF ADULT SALMON AND TROUT THROUGH AN INCLINED PIPE. Trans. Amer. Fish. Soc., 100(3): 448-455.

This research was designed to determine if migrating adult salmon and trout at Bonneville Dam on the Columbia River would use as a passageway an inclined pipe that required them to make a descent and an ascent before they reached the upstream end of the pipe. Chinook salmon (Oncorhynchus tshawytscha), sockeye salmon (O. nerka), coho salmon (O. kisutch), and steelhead trout (Salmo gairdneri) were tested with water velocities of about 0.30, 0.76, and 1.22 m/sec in a pipe that was 0.61 m in diameter and 31.4 m long. From 64 to 100% of the fish passed through the inclined pipe during a 45-min period. Median passage times ranged from 3 to 23 min. Chinook salmon passed through the pipe most rapidly at the 0.76 m/sec flow; coho salmon and steelhead trout passed through in the least time at 1.22 m/sec. Sockeye salmon passed through equally well at flows of 0.76 and 1.22 m/sec. (Auth.)

14139. Coble, Daniel W. (Missouri Coop. Fish. Unit, Univ. of Missouri, Columbia, Missouri). 1971. EFFECTS OF FIN CLIPPING AND OTHER FACTORS ON SURVIVAL AND GROWTH OF SMALLMOUTH BASS. Trans. Amer. Fish. Soc., 100(3): 460-473.

Fin clipped and control young-of-the-year smallmouth bass, Micropterus dolomieui Lacépède, were stocked in eight ponds and recovered a year later. A fin clip reduced survival; percentage recovery of fin clipped bass was about 1/2 to 1/3 that of control fish. No effect of fin clipping on growth was evident. Growth was inversely related to bass population density. When the effect of density on growth was removed, growth appeared to be curvilinearly related to minnow standing crop. Growth appeared to be food dependent at the lower food levels and independent at higher levels. (Auth.)

14140. Lewis, D. H., and Terry C. Allison (Dept. of Veterinary Microbiol., College of Vet. Med., Texas A&M Univ., College Station, Texas). 1971. AN IMMUNOFLUORESCENT TECHNIQUE FOR DETECTING Aeromonas liquefaciens IN FISH UTILIZED IN LUNAR EXPOSURE STUDIES. Trans. Amer. Fish. Soc., 100(3): 575-578.

14141. Parsons, John W. (U. S. Fish & Wildl. Serv., Great Lakes Fish. Lab., Ann Arbor, Michigan). 1971. SELECTIVE FOOD PREFERENCES OF WALLEYES OF THE 1959 YEAR CLASS IN LAKE ERIE. Trans. Amer. Fish. Soc., 100(3): 474-485.

Stomachs were examined from 1,473 walleyes (Stizostedion vitreum vitreum) of the 1959 year class collected in western Lake Erie from June 1959 to October 1960. In the same period, the relative abundance and lengths of potential forage species were determined from trawl catches. The walleyes fed almost entirely on fish. In 1959 the food was dominated first (in June and July) by yellow perch (Perca flavescens) and then in sequence, by spottail shiners (Notropis hudsonius) and emerald shiners (Notropis atherinoides). In 1960, the walleyes fed mostly on yearling spottail shiners and emerald shiners in the spring and summer but young alewives (Alosa pseudoharengus) became the dominant food in the fall. The length of forage fish increased with the length of walleyes and walleyes of a given length usually ate forage fish within a restricted range of lengths. This size preference was shown by walleyes of the same length in the same and different months. The increase in length of forage fish with length of walleye was not proportionate. Walleyes 2.5 inches long ate forage fish 0.44 times their length whereas walleyes 15.5 inches long ate forage fish only 0.28 times their length. The diet of the walleyes changed according to species and lengths of forage fish available. Since young of several species hatched in different months and grew at different rates, abundance and suitability as forage sometimes changed rapidly. (Auth.)

14142. Bellinger, John W., and James W. Avault, Jr. (Fish. Div., School of Forestry & Wildl. Mgmt., Louisiana State Univ., Baton Rouge, Louisiana). 1971. FOOD HABITS OF JUVENILE POMPANO, Trachinotus carolinus, IN LOUISIANA. Trans. Amer. Fish. Soc., 100(3): 486-494.

Food habits of juvenile pompano (Trachinotus carolinus) in Louisiana were determined during the summer of 1968. Stomachs of 899 juveniles were examined from stations at Grand Isle and Holly Beach, Louisiana. The fish ranged from 10 to 125 mm in total length. Percent frequency of occurrence, percentage of total volume, and seasonal variation in diet were determined. Juvenile pompano in Louisiana ate polychaetes, small clams, gastropod larvae, copepods, mysids, isopods, amphipods, postlarval shrimp, anomurans (sand crabs), brachyurans (juveniles, megalops, and eggs), insects, and small fishes. Small juveniles ate a wide variety of organisms and appeared to be opportunistic, apparently feeding on those organisms most abundant at the time. Larger juveniles ate a more limited diet, consisting primarily of coquina clams. (Authors)

14143. Regier, Henry A. (Dept. of Zool., Univ. of Toronto, Toronto, Canada). 1971. A MARK-RECOVERY METHOD FOR ESTIMATING ANGLERS' CATCH, WITH AN EXAMPLE FROM LAKE OPEONGO, ONTARIO. Trans. Amer. Fish. Soc., 100(3): 495-501.

Estimates of anglers' catch in complex lake-species-angler systems are usually obtained with ratio estimators using data on effort as a covariate, together with an estimate of the catch-per-unit-effort ratio. Practical and theoretical studies show that this approach can be expected to be very costly if estimates with useful precision are sought. The present study shows the practical feasibility of using a Petersen mark-recovery method for this purpose. The first part of such a census requires a worker to roam the lake contacting anglers "at random" and marking fish already creeled with a small but readily retrievable tag. The second part involves in-shore or on-shore workers who intercept anglers "at random" as they leave the lake and obtain from them data on marked and unmarked fish in their catch. The extensive literature on mark-recovery methods is directly relevant to this application of the technique. (Auth.)

14144. International Pacific Salmon Fisheries Commission (New Westminster, Canada). 1971. ANNUAL REPORT - 1970. International Pacific Salmon Fisheries Commission, 40 p., illus.

14145. Miller, Robert Rush, and Edwin P. Pister (Museum of Zool., The Univ. of Mich., Ann Arbor, Michigan). 1971. MANAGEMENT OF THE OWENS PUPFISH, Cyprinodon radiosus, IN MONO COUNTY, CALIFORNIA. Trans. Amer. Fish. Soc., 100(3): 502-509.

The Owens pupfish, Cyprinodon radiosus Miller, is restricted to Owens Valley along the eastern base of the Sierra Nevada Range of California. When it was described in 1948 it was thought to be extinct. Its depletion, rediscovery, and re-establishment in the Owens Valley Native Fish Sanctuary, a cooperative undertaking between the City of Los Angeles and the California Department of Fish and Game, are described. Two other refuges in Owens Valley are completed or under construction, and the three additional native fishes of this valley will be established in one of these. Such conservation activity reflects the growing concern of the scientific community and the public over the threat to native fishes. (Authors)

14146. Hoyt, Robert D. (Biol. Dept. Western Ky. Univ., Bowling Green, Kentucky). 1971. THE REPRODUCTIVE BIOLOGY OF THE SILVERJAW MINNOW, Ericymba buccata Cope, IN KENTUCKY. Trans. Amer. Fish. Soc., 100(3): 510-519.

The spawning period of the silverjaw minnow of Plum Creek in Shelby, Bullitt, and Spencer counties, Kentucky, extended from March through June, with the greatest spawning activity in April. Females of Age Group I had fewer primary ova with greater diameters than females of Age Groups II and III, which had successively more ova of smaller diameter. There was no correlation between diameter of ova and total length of female silverjaw minnows, but a high coefficient of correlation existed between number of ova and total length. The average number of mature ova was 748 and the average diameter was 0.75 mm. Spawning activity of fish in Pope Lick Creek, Jefferson County, Kentucky, in 1966, corresponded closely to that of fish in Plum Creek in 1968. Females of Age Group II formed the most important breeding class in Plum Creek, while females of Age Group I were most important in Pope Lick Creek. Numbers of males and females taken from Plum Creek were comparable. (Auth.)

14147. Eckroat, Larry R. (Dept. of Biol., The Pa. State Univ., University Park, Pennsylvania). 1971. LENS PROTEIN POLYMORPHISMS IN HATCHERY AND NATURAL POPULATIONS OF BROOK TROUT, Salvelinus fontinalis (Mitchill). Trans. Amer. Fish. Soc., 100(3): 527-536.

Lens protein phenotype and allele frequencies of three autosomal loci were analyzed by acrylamide gel electrophoresis for 1,164 specimens from four hatchery populations of brook trout, Salvelinus fontinalis (Mitchill), each representing combined progenies from random matings of hundreds of parents. A deficiency of heterozygous genotypes at one locus, according to Hardy-Weinberg analysis, may indicate a degree of inbreeding in the hatchery environment. Allele frequencies of the lens protein variations appeared to be relatively stable from year to year within a particular hatchery. Gene frequency analyses for the lens protein variations disclosed that brook trout populations from some of the different hatcheries were distinguishable from each other. Analyses of the lens proteins for 547 specimens from nine natural populations of brook trout revealed no genetic divergence in these small isolated populations. A length-frequency analysis of one population indicated that allele frequencies were independent of length classes. Evidence was presented suggesting that a distance greater than 300 yards may act as an isolating mechanism leading to genetic divergence of a brook trout population in one small stream. Gene frequency analyses for the lens protein variations disclosed that some of the brook trout natural populations from different areas sampled were distinguishable from each other. (Auth.)

14148. Wissing, Thomas E., and Arthur D. Hasler (Lab. of Limn., Univ. of Wis., Madison, Wisconsin). 1971. EFFECTS OF SWIMMING ACTIVITY AND FOOD INTAKE ON THE RESPIRATION OF YOUNG-OF-THE-YEAR WHITE BASS, Morone chrysops. Trans. Amer. Fish. Soc., 100(3): 537-543.

Rates of oxygen consumption were determined for: 1) single young-of-the-year white bass, Morone chrysops (Rafinesque), forced to swim in a rotating annular

respirometer, and 2) groups of young-of-the-year fish fed meals of live zooplankton. Sustained swimming activity and maximum metabolic rates generally occurred at a rotation velocity of 15 rpm. The decline in oxygen consumption with time and increased velocities in six experiments suggested decreases in excitement and swimming activity. Post-feeding increases in oxygen consumption were observed in six groups. After this initial elevation, metabolic rates continued to increase slightly or declined. The importance of measuring the components of total respiration and their caloric equivalents is stated and will be discussed in a subsequent paper. (Authors)

14149. Sills, Joe B., and John L. Allen (Southeastern Fish Control Lab., P. O. Box 9, Warm Springs, Georgia). 1971. THE INFLUENCE OF pH ON THE EFFICACY AND RESIDUES OF QUINALDINE. Trans. Amer. Fish. Soc., 100(3): 544-545.

Quinaldine, an anesthetic for fish, loses its effectiveness in solutions having pH values less than 6. Measured quantities of un-ionized quinaldine in solution compared favorably with calculated values at selected pH's. Quinaldine residues in largemouth bass (Micropterus salmoides) anesthetized at various pH's verify that only the un-ionized portion in solution enters the fish. Quinaldine residues in fish and un-ionized quinaldine in solution were measured by gas chromatography. (Authors)

14150. Maxfield, Galen H., Robert H. Lander, and Kenneth L. Liscom (NMFS, Biol. Lab., 2725 Montlake Blvd. East, Seattle, Washington). 1971. SURVIVAL, GROWTH, AND FECUNDITY OF HATCHERY-REARED RAINBOW TROUT AFTER EXPOSURE TO PULSATING DIRECT CURRENT. Trans. Amer. Fish. Soc., 100(3): 546-552.

Control (or unshocked) and shocked (or test) rainbow trout (Salmo gairdneri) were held through spawning to determine the effects of electrical shock on the survival, growth, and fecundity of two year classes - young of the year of the 1953 year class and yearlings of the 1952 year class - and on the survival of the eggs and of the fry of the exposed fish. The test groups were exposed for 30 sec. to one of two sets of electrical conditions - the young of the year to a pulse frequency of 8 pulses/sec, a pulse duration of 40 milliseconds, and a voltage gradient of 1 volt/cm; and the yearlings to a pulse frequency of 5 pulses/sec, a pulse duration of 60 milliseconds, and a voltage gradient of 0.75 volt/cm. The exposure was longer than that usually encountered by fish during either electrical fish guiding or collection with a pulsating direct-current shocker. The survival, growth, and fecundity of the fish apparently were not affected by the electrical shock, nor were the survival and development of their offspring. (Authors)

14151. Dickson, Kenneth L., John Cairns, Jr., and Jesse C. Arnold (Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. AN EVALUATION OF THE USE OF A BASKET-TYPE ARTIFICIAL SUBSTRATE FOR SAMPLING MACROINVERTEBRATE ORGANISMS. Trans. Amer. Fish. Soc., 100(3): 553-559.

The results obtained from the use of bottom, basket type, artificial samplers, were analyzed statistically to determine the samplers' efficiency in collecting aquatic macroinvertebrates. Two ecologically similar riffle stations located near McCoy, Virginia on the New River were chosen for this evaluation. Based on an analysis of the number of taxa collected, 15 basket samplers at Station 1 showed a range of seven taxa with a coefficient of variation of 11.6%. Station 2, located 500 yards upstream, with 16 samplers, had a range of 11 taxa with coefficient of variation of 16.29%. In an evaluation of the number of specimens collected, Station 1 had a range of 39 specimens with a coefficient of variation of 10.9%. Station 2 had a range of 103 specimens which was larger than the average of 85.6 specimens per sampler. To be 95% confident that the mean community structure indices for each station [Sequential Comparison Index and diversity per individual (d) were within 25% of their true value, only two basket samplers were needed. However, four samplers at Station 1 and six samplers at Station 2 would be required for the number of taxa collected. Due to unequal distribution of macroinvertebrates on the bottom, or sampling design bias, 21 samplers at Station 2

would be required to be 95% confident that the mean number of specimens collected was within 25% of its true value. An estimate of the proportion of taxa which would have been detected on the average by a smaller number of basket samplers showed that at least five basket samplers were necessary at each station in order to be 95% confident that at least 50% of the total number of taxa were collected. When using this type of substrate sampler for collecting macroinvertebrates in a comparison of the biological water quality between selected stations, the number of taxa collected by the samplers and the community structure of the macroinvertebrates are less variable than the number of specimens obtained. These types of analyses can serve as the basis for establishing the appropriate number of samplers for a routine survey. (Authors)

14152. Howmiller, Richard P. (Center for Great Lakes Studies, Univ. of Wisconsin-Milwaukee, Milwaukee, Wisconsin). 1971. A COMPARISON OF THE EFFECTIVENESS OF EKMAN AND PONAR GRABS. Trans. Amer. Fish. Soc., 100(3): 560-564.

The effectiveness of 9 x 9 inch (23 cm) Ekman and Ponar grabs was compared at 26 stations in Green Bay; on hard (N = 8) and soft (N = 18) sediments. On hard sediments the Ponar caught significantly more midge larvae (99%), but not more oligochaete worms, than the Ekman. On soft sediments the Ekman caught significantly more midges (98%) and worms (95%) than the Ponar. Differences in effectiveness of the grabs are discussed in relation to their construction. The Ponar is heavier and bites more effectively into hard substrates. The Ekman probably creates less of a shock wave and can penetrate farther into soft sediments. (Auth.)

14153. Priegel, Gordon R. (Wisconsin Dept. of Natural Resources, Madison, Wisconsin). 1971. AGE AND RATE OF GROWTH OF THE WHITE BASS IN LAKE WINNEBAGO, WISCONSIN. Trans. Amer. Fish. Soc., 100(3): 567-569.

The white bass, Morone chrysops (Rafinesque) is the most abundant panfish species in Lake Winnebago; however, it is a cyclic fish reaching tremendous numbers at times and then decreasing to low population levels. Age and rate of growth data for the white bass in this extensive water area have been lacking. No significant difference in growth between sexes was found so data were combined. Grand average calculated growth increment decreased each year through the seventh year of life. The calculated growth increment during the seventh and eighth year of life was the same. The grand-average calculated length for the first year based on summation of increment for Lake Winnebago white bass was 97 mm. During the second year there was a growth increment of 94 mm while in the third year there was a growth increment of 69 mm. Greatest yearly increments of growth occurred during the first 3 years of life followed by annual growth variability between 8 and 18 mm. At the end of 8 years the grand average length was 320 mm. Growth of Lake Winnebago white bass was slower than that reported from most areas of the United States.

14154. Cooper, James A. (Mass. Coop. Wildl. Unit, Dept. of Forestry & Wildl. Mgmt., Univ. of Mass., Amherst, Massachusetts). 1971. SCALE DEVELOPMENT AS RELATED TO GROWTH OF JUVENILE BLACK CRAPPIE, Pomoxis nigromaculatus Lesueur. Trans. Amer. Fish. Soc., 100(3): 570-572.

This paper describes the scale development of black crappie, Pomoxis nigromaculatus, taken from the Connecticut River Oxbow. Scales first appeared directly posterior to the dorsal and anal fins and anterior to the pelvic fins. Scale formation then extended posteriorly to the base of the caudal fin and anteriorly along the dorsal and ventral midlines with lateral extension to the lateral line. Simultaneously, scale development proceeded posteriorly and dorsally from the region in front of the pelvic fins. Lateral line scales appeared initially at the base of the caudal fin and in the most anterior region of the lateral line. Further development was anterior and posterior respectively, with the last lateral line scales formed being those just beneath the first dorsal fin spine. Body scale development was completed by 36 mm, head scales by 38 mm, and opercal scales by 40 mm. The largest specimen without scales was 34 mm and the smallest fully scaled fish was 37 mm.

14155. Kimball, Dan C., and William T. Helm (Dept. of Wildl. Resources, Utah State Univ., Logan, Utah). 1971. A METHOD OF ESTIMATING FISH STOMACH CAPACITY. Trans. Amer. Fish. Soc., 100(3): 572-575.

A technique for estimating stomach capacity from body length is presented. The procedure was to measure stomach capacity of many fish over the size range of a given species and then to relate stomach capacity to body length by regression analysis. Stomach capacities of fish sampled later can be estimated (by graph or table) from fork lengths measured in the field. The technique was applied to brown trout (Salmo trutta Linnaeus) and mountain whitefish (Prosopium williamsoni Girard) and found that it eliminates much of the subjectivity inherent in visual estimates. Further regression analysis provides a measure of the error in the estimates.

14156. Kopperdahl, Fredric R., James W. Burns, and Gary E. Smith (The Resources Agency of Calif. Dept. of Fish and Game, Sacramento, California). 1971. WATER QUALITY OF SOME LOGGED AND UNLOGGED CALIFORNIA STREAMS. Calif. Dept. of Fish and Game Inland Fisheries Administrative Report No. 71-12, 19 p.

Water quality was monitored in 1968 and 1969 in six coastal streams in northern California, four of which were subjected to logging and/or road building (Bummer Lake Creek, South Fork Yager Creek, Little North Fork Noyo River, and South Fork Caspar Creek), while the others remained undisturbed (Godwood Creek and North Fork Caspar Creek). The purposes of this study were to characterize the water quality of the streams, to determine if the logging and road construction drastically altered water quality, and to collect water quality data which could be tested for predicting stream carrying capacities for salmonids. Conditions were generally suitable for salmonids during and after the logging. No abnormal concentrations of dissolved oxygen, alkalinity, hardness, dissolved solids, phosphate, chloride, sulfate, nitrate, tannin and lignin, or pH were detected. Carbon dioxide was low in most streams, except in South Fork Caspar Creek when it reached 8 ppm during the decomposition of logging debris in the summer of 1968. Turbidity was highest in areas where bulldozers were working in the streams. Temperatures of most streams increased after the logging, but seldom exceeded 70 F because of the cool climate in the coastal fog belt. Alternating cut and uncut blocks on one stream, and retaining a buffer strip along another, kept temperatures low in two streams. (Authors summ.)

14157. Uyeno, Teruya, and Robert Rush Miller (Museum of Zool., Univ. of Mich., Ann Arbor, Michigan). 1971. MULTIPLE SEX CHROMOSOMES IN A MEXICAN CYPRINODONTID FISH. Nature, 231(5303): 452-453.

The chromosomes of the killifish family Cyprinodontidae are being studied in many laboratories and the karyotypes of forty-eight of the approximately eighty-five species of North American killifishes have so far been determined. This report concerns one species, representing an undescribed genus, which is unusual in that it has a diploid number of 48 in the female and 47 in the male. Somatic metaphase karyotypes of both sexes include one pair of metacentric, eighteen pairs of submetacentric-subtelocentric and four pairs of acrocentric chromosomes; in addition the female possesses a pair of acrocentric chromosomes and the male a single large metacentric chromosome. The unpaired chromosome in the male is about three to five times longer than any other chromosome. This is the first example of a multiple sex chromosome mechanism in fishes.

14158. Hamer, Paul E. (N. J. Dept. of Environ. Protection, Div. of Fish, Game, and Shellfish, Marine Fisheries Section, New Jersey). 1971. MIGRATORY PATTERNS OF SOME NEW JERSEY STRIPED BASS, Morone saxatilis. N. J. Dept. of Environmental Protection, Miscellaneous Report No. 6M, 23 p. + 1 fig.

Striped bass from a wintering population, a spawning population and a juvenile population were tagged in southern New Jersey waters. Tag recoveries indicate that the wintering population migrated north to southern New England and returned, while the spawners and juveniles moved out of the rivers in which they were tagged into Delaware and Chesapeake Bays for the winter. (Auth.)

14159. Pyle, A. Bruce, and Robert H. Soldwedel (N. J. Dept. of Environ. Protection, Div. of Fish, Game and Shellfisheries, Freshwater Fish. Lab., Lebanon, New Jersey). 1971. FLATBROOK TROUT STUDIES. N. J. Dept. of Environ. Protection Miscellaneous Report No. 33, 139 p. + XXV tables in appendix.

Studies were conducted over three years on representative sections of the Flatbrook Drainage to obtain information on their suitability for trout, and on two of these detailed information was gathered via creel census and trout tagging in combination with physical-chemical determinations to provide insight into the factors affecting the catch and harvest of brook, brown and rainbow trout stocked weekly under a "put-for-take" program. One of the areas studied in detail was open to angling by any means while the other was closed to all but fly-fishing after about four to five weeks of the stocking season. It is estimated that 75.6 percent of the stocked trout were either caught or harvested from the section that was more suitable for trout and restricted at times to fly-fishing. The area less suited to trout experienced an estimated 62.9 percent use of the stocked trout. A progressive decrease in the return of sequentially stocked trout makes it advisable to recommend discontinuation of stocking in early June in the better area and about mid-May in the poorer. The bulk of the harvest was in the week immediately following stocking. Rainbow trout provided the best overall return and comparable angling with brook trout in early season and with brown trout for extended post-stocking harvest. Movement of stocked trout was stimulated by increased stream flow and this acted to decrease total return and angler success. In general, movement was least by the species best suited to the stream into which they were stocked. The five one-inch length classes of trout stocked experienced a decrease in harvest of about five percent with each successively smaller length class. Culling and attrition are considered principal causative factors that are believed can be ameliorated in their effect by stocking fish of lesser length range. Disease is indicated as another possible cause for loss. Angler effort was found more closely related to linear stream distance than to acreage and decreased at a rate of about 0.33 angler days per day in the open fishing area over a nine week season. Implementation of the fly-fishing-only regulation caused a reduction in angler use, a polarization of fly anglers to the area, and use of the area by fewer individual anglers who fished more frequently and experienced the same catch rate as bait anglers. As a result it was recommended against restricting the use of water to fly-fishing-only. (Authors)

14160. Schneider, James C. 1971. CHARACTERISTICS OF A POPULATION OF WARM-WATER FISH IN A SOUTHERN MICHIGAN LAKE, 1964-1969. Michigan Dept. of Natural Resources, Research and Development Report No. 236, 158 p.

The fish populations of Mill Lake were observed during the 5-year period from October 1964 to October 1969; during this period, public fishing was not allowed. The size of the fish populations was estimated each spring by means of mark-and-recapture techniques. Data on growth and food habits were also collected. Age structure, year class strength, and natural mortality rates of the fish populations were determined. Descriptive models of "typical" year classes were developed. Large changes occurred in the size and age structures of the bluegill, pumpkinseed and yellow perch populations; smaller changes occurred in the black crappie, largemouth bass and northern pike populations. These changes were caused mainly, if not entirely, by natural fluctuations in year class strength. Fluctuations in recruitment seemed to be density independent, except perhaps at high densities of fish. Growth of pike and bass, and to a lesser extent, of perch and crappies, was density related. Natural mortality was not density dependent for most species. Evidence is presented that bluegill, perch, bass and pike populations are food limited. (Auth.)

14161. Bartsch, A. F. (Pacific Northwest Water Lab., Fed. Water Qual. Admn., Dept of the Interior, Corvallis, Oregon). 1970. ACCELERATED EUTROPHICATION OF LAKES IN THE UNITED STATES: ECOLOGICAL RESPONSE TO HUMAN ACTIVITIES. Environ. Pollut., 1(2): 133-140.

Whatever the natural rate of eutrophication may be, the influences of human cultural activities typically accelerate the process, often leading to drastic disturbances of freshwater ecosystems and highly undesirable results. Various known

actions may lead to rearrangement of plant nutrients in the environment or to making them far more easily accessible than is normal for biological use and processes. Notable sources of nutrients or bases of change are municipal sewage and urban drainage, select industrial wastes, rural lands with their agricultural uses, and atmospheric precipitation. The most promising remedial approaches will be those which curtail the nutrient input to the aquatic system. (Auth.)

14162. Topp, Robert W., and Dale S. Beaumariage (Fla. Dept. of Natural Res., Marine Research Lab., St. Petersburg, Florida). 1971. TWO UNUSUAL STRIPED MULLET, Mugil cephalus, FROM THE FLORIDA WEST COAST. Trans. Amer. Fish. Soc., 100(3): 579-580.

Two striped mullet, Mugil cephalus Linnaeus, one exceptionally large and one with a brevispondylous condition, resulting in a disproportionately short body, were reported during 1969. The large specimen (FSBC 5664) was captured by Mr. Al Turner by castnet in Vinoy Basin, St. Petersburg (27° 47'N lat, 82°, 37'W long), on 26 December 1969. Length at capture was reported as 27.5 inches (698 mm) FL, girth 15.5 inches (394 mm) and weight 9 lb 10 oz (4.4 kg). The anomalous specimen (FSBC 6157), a 283 mm SL female in spawning condition, was found among a catch of some 2,000 mullet taken by gill net at Cedar Key, Florida (29° 08'N lat, 83° 05'W long) in mid-September 1969. The unusual preseason spawning condition of this specimen suggests the deformity could be linked to endocrine malfunction.

14163. Murawski, Walter S. 1970. RESULTS OF TAGGING EXPERIMENTS OF SUMMER FLOUNDER, Paralichthys dentatus, CONDUCTED IN NEW JERSEY WATERS FROM 1960 TO 1967. N. J. Dept. of Environ. Protection, Div. of Fish, Game and Shellfish, Nacote Creek Res. Sta., Miscellaneous Report No. 5M, 25 p + 53 figs.

Six tagging experiments of the summer flounder (Paralichthys dentatus) in the years 1960, 1961, 1966 and 1967 were conducted in the inshore waters of New Jersey. The Petersen and Atkins tags were used and their comparison showed a much greater retention by the former, however, its vulnerability to netting material necessitated the formulation of a correction factor for the determination of the various population dynamics parameters. Samples of the recaptured fish indicated female to male ratios as high as 3.0 with the females averaging larger in size than the males. Sport fishermen accounted for between 25 and 59 percent of the recaptures with a tendency towards a decrease of this value within the course of the study period. Of the commercially caught fish, the otter trawl accounted for over 92 percent. The winter trawl fishery was estimated to have captured between 1.4 and 4.8 percent of those tagged fish at large at the beginning of the winter. Estimates of the harvest rates of the six groups ranged from 10.9 to 24.0 percent accompanied by survival rates of .14 to .19. The monthly movements of each of the tagging groups are presented. The chief findings were the mixing of Sandy Hook and Cape May fish on the spawning and wintering grounds; an apparent southerly movement on their wintering grounds during late winter; an abandoning of the wintering grounds east of Hudson Canyon during the winters of 1966 and 1967 as a possible result of a decrease in population size and a return to the area of tagging during the following summer of a major portion of the returnees with the remainder being taken in waters to the north and east of the tagging area. This straying resulted in the loss of approximately one-third of the returnees to waters outside the State of New Jersey. Analysis showed these fish to be smaller than those that were recaptured at their tagging site thus suggesting a difference in the migratory pattern by either the age or sex classification. (Auth.)

14164. Wrenn, William B. (Tennessee Valley Authority, Muscle Shoals, Alabama). 1968. LIFE HISTORY ASPECTS OF SMALLMOUTH BUFFALO AND FRESHWATER DRUM IN WHEELER RESERVOIR, ALABAMA. Proc. of 22nd Ann. Conf. of Southeastern Assoc. of Game and Fish Comm., 17 p.

The life histories of smallmouth buffalo (Ictiobus bubalus) and freshwater drum (Aplodinotus grunniens) were studied during 1966-1968 in conjunction with the

evaluations of commercial fishery gear on Wheeler Reservoir. In this reservoir, smallmouth buffalo grows as fast as or faster than it does in other reservoirs. They are 5 to 6 years old and 17 to 19 inches long before they are abundant in the commercial catch. Drum growth is slower in Wheeler than in other waters; they are not important commercially until they are 7 to 8 years old and 16 to 19 inches long. Asiatic clams, 1 to 2 mm in diameter, and copepods were the dominant food items for all sizes of buffalo. Drum less than 10 inches fed primarily on diptera larvae; those over 10 inches fed primarily on Asiatic clams greater than 10 mm diameter and gizzard shad. Peak spawning periods in 1967 were mid-April for smallmouth buffalo and late-May for drum. Reproduction potential of both species is high. Female drum, 8 to 13 pounds, had an average of 686,000 eggs; smallmouth buffalo, 5 to 6 pounds, averaged 230,000 eggs. All male drum in age-group IV and all females in age-group VI were mature. All male and female buffalo were mature in age-groups VI and VII, respectively. Larvae of both species were collected in the reservoir; smallmouth buffalo were spawned artificially in indoor tanks. According to tag returns, buffalo moved an average minimum distance of 7.0 miles and a maximum of 56 miles. The study emphasized the need for more effective gear to harvest the surplus of small drum. (Auth.)

14165. Bays, L. R. (Bristol Waterworks, Great Britain). 1971. PESTICIDE POLLUTION AND THE EFFECTS ON THE BIOTA OF CHEW VALLEY LAKE. Environ. Pollut., 1(3): 205-234.

Pesticides arising from sheep dip residues deposited some miles away on the land passed into an underground storage system and eventually into a feeder stream of the Chew Valley lake. They either killed or prevented the reproduction of Daphnia sp., Bosmina sp. and some Chironomid larvae. The crustaceans had been grazing on unicellular algae, which, in their absence, caused a severe algal bloom, which made the water supply temporarily unpotable. (Auth.)

14166. Orsi, James J. (Calif. Dept. of Fish and Game, Anadromous Fish. Br., Sacramento, Calif.). 1970. A COMPARISON OF SCALES, OTOLITHS, AND OPERCULAE IN STRIPED BASS AGING. The Resources Agency, Dept. of Fish and Game, California, Anadromous Fish. Admn. Report No. 70-15, 5 p.

Scales, otoliths, and operculae from 103 striped bass were aged. Good aging agreement was obtained between them. Either otoliths or operculae can provide useful checks on the accuracy of the scale aging method. But for young striped bass operculae are preferred because false annuli are easily detected on them and little experience is required to age them. However, all three structures often have false annuli and since most bass can be aged accurately from the scales and because operculae and otoliths are much more difficult to obtain, prepare and store than scales, it would be best to continue to depend on scales for age determinations in routine striped bass field programs. (Auth. summ.)

14167. Veith, Gilman D., and G. Fred Lee (Water Chemistry Lab., Univ. of Wis., Madison, Wisconsin). 1971. WATER CHEMISTRY OF TOXAPHENE - ROLE OF LAKE SEDIMENTS. Environmental Science & Technology, 5(3): 230-234.

The role of lake sediments in the detoxification of lakes which were treated with toxaphene was evaluated under environmental and laboratory conditions. The extent of toxaphene accumulation in sediments of three Wisconsin lakes was determined by electron capture gas chromatographic analysis of core sections and Ekman dredge samples. The toxaphene concentration in the 0 to 5-cm level of the sediment increased for 190 days following the treatment of the lakes and then began decreasing by a factor of 2 every 120 days. Toxaphene was transported vertically to the 5 to 10-cm and the 10 to 15-cm level of the sediment at rates varying from 0.4 to 1.1 cm per day in the three lakes. Toxaphene was not detected below the 20-cm level of the sediments. Toxaphene which was sorbed onto the sediment in the lake could not be leached from the sediment by lake water under laboratory conditions. (Authors)

14168. Candido, E. P. M., and Gordon H. Dixon (Dept. of Biochem., The Univ. of Brit. Columbia, Vancouver 8, Canada). 1971. SITES OF in Vivo ACETYLATION IN TROUT TESTIS HISTONE IV. J. Biol. Chem., 246(10): 3182-3188.

During the process of spermatogenesis in rainbow trout, there is extensive acetylation of some histone fractions. A large proportion of the acetyl groups is present in histone IV, and the sites of acetylation in this fraction have been determined. Four lysyl residues in the HG_2-terminal region at positions 5, 8, 12, and 16 were found to be acetylated in a fraction of the histone IV molecules. Acetylation of each of these 4 lysyl residues can probably occur independently of the others, at least to some extent. This leads to a complex mixture of modified histone IV molecules, which is partially reflected in the starch gel pattern of this protein. There seems to be no acetylation of the other lysyl residues in the molecule. (Authors summ.)

14169. Snyder, George R., Theodore H. Blahm, and Robert J. McConnell (NMFS, Biol. Lab., Seattle, Washington). 1971. FLOATING LABORATORY FOR STUDY OF AQUATIC ORGANISMS AND THEIR ENVIRONMENT. U. S. Dept. of Comm., NOAA, NMFS, Circular 356, 16 p. illus.

The National Marine Fisheries Service has built a floating laboratory to study environmental problems in the Columbia River. The barge that supports the laboratory was obtained from the U. S. Navy. Installation of a complex electrical and water supply system plus biological research equipment aboard the barge have made it possible to conduct research near sites where problems are expected to occur. (Authors)

14170. Rogers, Wilmer A. (Southeastern Coop. Fish Disease Project, Auburn, Univ. Agric. Exp. Sta., Auburn, Alabama). 1969. A SUMMARY OF FISH DISEASE CASES RECEIVED OVER A FIVE-YEAR PERIOD AT THE SOUTHEASTERN COOPERATIVE FISH DISEASE LABORATORY. Reprint from Proc. of 23rd Ann. Conf. of the Southeastern Assoc. of Game and Fish Commissioners, pp. 353-358.

During the period July 1, 1964 to June 31, 1968, a total of 300 cases was received for diagnosis at the Southeastern Cooperative Fish Disease Laboratory at Auburn University. Ninety of the cases (30%) were determined to be caused by parasites, 104 cases (34.7%) were determined to be caused by bacteria or viruses. The remainder of the cases were routine prestocking checks, kills due to factors other than disease producing organisms, or undetermined cases due to unsuitable specimens for diagnosis or lack of data. A detailed breakdown of the cases is given including seasonal occurrence, prevalent organisms associated with epizootics, and environmental factors associated with epizootics when known. (Auth.)

14171. Meske, Ch. (Max-Planck-Institut für Kulturpflanzenzüchtung, Ahrensburg, Germany). 1971. WARM-WATER PISCICULTURE. THE NEWEST BRANCH OF AQUACULTURE. (Warmwasser-Fischzucht. Neue Verfahren der Aquakultur). Naturwissenschaften, 58(6): 312-318. In German with English abstract.

New methods for keeping, feeding and breeding carp and other fish in running warm water are described. In a closed circuit ("system Ahrensburg") the water is recycled through a biological clarifying plant and is maintained at a constant temperature, thus enabling the employment of these new methods independently of environmental pollution. The development of weight and of sexual maturity is very fast, which makes experiments on the biology of reproduction and breeding much easier. Warm-water pisciculture opens up new possibilities for the production of marketable fish. (Auth.)

14172. Purdom, C. E., and A. E. Howard (Fish. Lab., Lowestoft, Suffolk, England). 1971. CILIATE INFESTATIONS: A PROBLEM IN MARINE FISH FARMING. J. Cons., 33(3): 511-514.

Ciliate infestations, particularly of Helicostoma, have been shown to be lethal to a variety of young fish under marine hatchery conditions. Susceptible species include soles, plaice, eels and blennies. Since Helicostoma is a widely occurring marine ciliate, this type of infestation represents a major hazard in marine fish

farming and may in part be responsible for the high mortalities observed amongst 0-group soles in rearing trials. A possible prophylactic treatment is formaldehyde, at a concentration of 1 part in 20,000, applied to fish and containers at monthly intervals. Adult soles appear not to be affected and juveniles over 15 cm in length are probably also safe. Most of the work reported here was done at a temperature range of about 16-20°C. It is probable that ciliate division cycles are temperature dependent and that less trouble would be experienced in fish-rearing enclosures maintained at temperatures below 16°C. This would cause a slower growth rate of the fish, but a low temperature might be necessary for only the initial period of growth of 0-group soles.

14173. Oren, O. H. (United Nations Development Programme; Abidjan, Ivory Coast, Africa). 1971. INTERNATIONAL BIOLOGICAL PROGRAMME: COORDINATED STUDIES ON GREY MULLETS. Marine Biology, 10(1): 30-33.

The International Biological Programme/Marine Productivity Section (IBP/PM) initiated cooperation in world-wide studies on the grey mullet; grey mullets are of great economic importance in many places in the world, but mainly in the tropical and subtropical regions. The aim of IBP/PM is the intensification of studies and the use of lagoons and estuaries for fish production. The importance of the mullet lies also in the fact that it is a detritus feeder, a fast growing fish, and can be successfully bred under artificial conditions. To make cultivation of these fish economical and independent of natural supply (which is becoming ever more unreliable through pollution of lagoons and coastal waters), the life cycle of these fish has to be completed and the problem of induced spawning solved. Such investigations are underway in several laboratories in the world. Dissemination of the knowledge acquired, accumulation of experience on this subject, and eventual use of the results as models for induced spawning and cultivation of other species of fish and invertebrates, is another aim of IBP/PM. (Auth.)

14174. Aoki, T., S. Egusa, Yasuko Ogata, and T. Watanabe (Dept. of Fish., Fac. of Agric., University of Tokyo, Tokyo, Japan). 1971. DETECTION OF RESISTANCE FACTORS IN FISH PATHOGEN Aeromonas liquefaciens. J. Gen. Microbiol., 65(3): 343-349.

Thirty-nine out of 72 drug-resistant strains of Aeromonas liquefaciens isolated from cultured fish and soft-shelled turtles (Trionyx sinensis japonicus) in various districts of Japan carried transferable drug resistance factors. The fish included eel (Anguilla japonica), carp (Cyprinus carpio), ayu (Plecoglossus altivelis) and goldfish (Carassius auratus). The most common type of resistance factors had the markers of resistance to sulphanilamide and tetracycline and all belonged to the fi-type. Transferable drug resistance was not found in any of 12 strains of A. liquefaciens isolated from wild eels. The high incidence of resistance factors in A. liquefaciens from cultured fish is assumed to be due to the selective pressure exerted by chemotherapeutics used in fish culturing. (Authors)

14175. Ackefors, Hans (Dept. of Zool. and the Asko Lab., Univ. of Stockholm, Sweden). 1971. A QUANTITATIVE PLANKTON SAMPLER. Oikos, 22(1): 114-118.

A new construction of a plankton sampler for ecological studies is described. The capacity of the sampler is 23 litres. The vertical distribution of zooplankton in fixed levels in the water column can be studied. The sampler can be used in shallow as well as deep waters. As the sampler is provided with a bag net the water is filtered before the sampler is taken on board. This makes the sampler light enough to be handled by one man in a small boat with the help of a handwinch. The greatest attention has been paid to the mechanical construction of the closing device. The sampler can easily be modified to take water samples for chemical or phytoplankton studies. (Auth.)

14176. Whipple, William, Jr., and Shaw L. Yu (Water Resources Research Inst., Rutgers Univ., New Brunswick, New Jersey). 1971. ALTERNATIVE OXYGENATION POSSIBILITIES FOR LARGE POLLUTED RIVERS. Water Resources Research, 7(3): 566-579.

The idea of induced aeration of polluted rivers is gaining acceptance, prototype

equipment having been installed on the Miami River in Ohio and on the Ruhr River in Germany. Previous analysis and reports have indicated the general feasibility of aeration on small rivers. This paper describes tests of aeration equipment on a major river, the Delaware Estuary, and discusses transfer efficiency, suitable aerator system design, and cost comparisons. Navigational considerations and deeper, more turbulent water cause design requirements for large rivers to differ considerably from the requirements for small rivers. Reinforced aerators at the surface appear favorable for uncrowded river areas, but air diffusers on the bottom appear more practicable and comparably economical for port areas. Diffusers can be placed only on channel margins and anchorage areas, but dispersion studies indicate that the oxygenated water will still reach the center of the river within a reasonable distance. The cost of adding one unit of dissolved oxygen by aeration devices appears to be just about one-fourth that of adding it by officially approved waste treatment only. There are possibilities of lowering costs further by using oxygen diffusers. Institutional barriers that make it difficult to plan and develop pollution control alternatives such as river aerators are discussed. (Authors)

14177. DeVries, Arthur L. (Physiol. Res. Lab., Scripps Inst. of Oceanogr., Univ. of Calif., San Diego, California). 1971. GLYCOPROTEINS AS BIOLOGICAL ANTIFREEZE AGENTS IN ANTARCTIC FISHES. Science, 172(3988): 1152-1155.

The blood serums of Antarctic fishes freeze at -2°C, which is approximately 1°C below the melting points of their serums. This thermal hysteresis is due to the influence of serum glycoproteins. The temperatures of freezing and melting of aqueous solutions of the purified glycoproteins suggest that this thermal hysteresis results from the adsorption of the glycoprotein molecule onto the surface of ice crystals. (Auth.)

14178. Petersson, Ake (Dept. of Animal Ecology, Univ. of Lund, Sweden). 1971. THE EFFECT OF LAKE REGULATION ON POPULATIONS OF CESTODAN PARASITES OF SWEDISH WHITEFISH Coregonus. Oikos, 22(1): 74-83, Copenhagen.

The occurrence of Triaenophorus crassus and Cyathocephalus truncatus (Cestoda) in whitefish Coregonus was compared in non-regulated and regulated lakes. In non-regulated lakes, Coregonus peled and C. oxyrhynchus with a high number of gillrakers and a high frequency of plankton in the diet were most heavily infested. In regulated lakes differences between Coregonus spp. were absent or small. C. pidschian and C. nasus with a low number of gillrakers feed on plankton to a much higher extent in regulated lakes and become more heavily infested. In populations with low infestation no correlation was found between frequency of T. crassus and age of fish, but in populations with high infestation such a correlation was established (up to 7 years old fish). Infestation of T. crassus did not affect the ratio weight: length of the fish. C. truncatus was absent from all regulated lakes, its intermediate host Gammarus being highly sensitive to changes provoked by the regulation. (Auth.)

14179. Watanabe, Taisuke. 1970. MORPHOLOGY AND ECOLOGY OF EARLY STAGES OF LIFE IN JAPANESE COMMON MACKEREL, Scomber japonicus Houttuyn, WITH SPECIAL REFERENCE TO FLUCTUATION OF POPULATION. Bull. Tokai Reg. Fish. Res. Lab., No. 62, pp. 1-283. In Japanese with English abstract and summary.

The Japanese common mackerel, Scomber japonicus Houttuyn, is a typical migratory fish, which is widely distributed in the temperate zone along the coast of Japanese Islands. This species is one of the important commercial stocks of pelagic-neritic fish in Japan. The recent increase of mackerel catch in Japan is due to a remarkable enlargement of the population of a specific fraction of the Pacific coast of Honshu. This fraction occupies an area extending from the Pacific coast of Honshu north to the southern shore of Hokkaido as the migratory range. The annual catch from this fraction for the period 1965 through 1967 reached over 400 thousand tons which is 60-70 percent of the total mackerel catch of Japan. It is necessary to study the life history of mackerel of each fraction or race in connection with the environment and the fishery for clarifying the mechanism of

fluctuation of mackerel stocks. Notwithstanding, neither knowledge on the biology of early stages of life of mackerel has been contributed, nor critical analyses for mechanisms of recruitment and stock fluctuations have been done from viewpoints of estimation of spawning amount and survival rate, as well as quantitative correlation between parents and their progenies. The present paper elucidates the mechanism of population fluctuation on the basis of biological information, particularly of early stages of life, on the specific fraction of the Pacific coast of Honshu. (Auth.)

14180. Wahlquist, Harold (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1969. EFFECT OF WATER HYACINTHS AND FERTILIZATION ON FISH-FOOD ORGANISMS AND PRODUCTION OF BLUEGILL AND REDEAR SUNFISH IN EXPERIMENTAL PONDS. Reprint from Proc. of the 23rd Ann. Conf. of the Southeastern Assoc. of Game and Fish Commrs., pp. 373-384.

Eighteen 0.1-acre ponds at the Auburn University Fisheries Research Unit, Auburn, Alabama, were used from April 5 through November 20, 1967. Both species of fishes were stocked together randomly at a rate of 4,000 fingerlings per acre. The experimental design consisted of three control ponds without fertilization or hyacinths; three control ponds without fertilization, but with hyacinths; three ponds with 0-8-0 fertilization, but with hyacinths; three ponds with 8-8-0 fertilization, but no hyacinths; and three ponds with 8-8-0 fertilization, but with hyacinths. The fertilizers were applied to stimulate the growth of hyacinths and fish-pond organisms. Greater numbers and dry weights of fish-food organism were associated with roots of water hyacinths in control ponds than in fertilized ponds. Snails and odonate nymphs were dominant in control ponds but were not important in fertilized ponds. Dry weight of amphipods and midge larvae did not differ significantly between the control and two fertilizer treatments. Low numbers and dry weights of fish-food organisms in fertilized ponds containing hyacinths was probably due to heavy predation by the sunfishes. Upon draining the fish production was greater in fertilized ponds containing plants compared to control hyacinth ponds. In the unfertilized ponds the mean standing crop of fish at draining time was approximately the same in both hyacinth and non-hyacinth ponds. The mean standing crop from fertilized ponds was at least twice as great in non-hyacinth ponds as in hyacinth ponds. The reduced fish production in hyacinth ponds was probably a result of competition for nutrients between the water hyacinths and plankton food-chain, and of the reduction of "edge" for fish-food organisms on the roots. (Auth.)

14181. Georgia Game and Fish Commission, Sport Fisheries Division. 1971. REPORT ON FRY PRODUCTION AND REARING OF FINGERLING STRIPED BASS Morone saxatilis (Walbaum) AT RICHMOND HILL FISH HATCHERY, GEORGIA. Ga. Game and Fish Comm. Contribution Series No. 3, 39 p.

"Eligible" or advanced striped bass females for hormonal ovulation can be collected electrofishing with some consistency in the Savannah Back River from 20.1 to 27.2 miles upstream. Preliminary efforts with a pound net appear favorable and indicate it would be, comparatively, more efficient in terms of catch per effort as a method of collecting broodfish. In future years a net should be utilized in the upper reaches of or in close proximity to the tidal zone in the St. Marys, Big Satilla, Altamaha, Ogeechee and Savannah River systems. A single muscular injection of mammalian chorionic gonadotrophin at 200 international units per pound of broodfish was sufficient to ovulate females in Stage I or advanced. The total number of broodfish spawned was low for comparisons of dose levels. However, it seems significant that a better hatch was consistently obtained with the 200 I.U. rate. Latency periods were quite variable and warrant further investigation. Size of broodfish as related to dose level should be investigated. A dissolved oxygen level of 3 p.p.m. where the water temperature is 86°F and free carbon dioxide is 44 p.p.m. is critical for 47 day old fingerlings. Fingerlings 31 to 33 days old are not visually distressed when the dissolved oxygen is at 3 p.p.m., the water temperature as low as 82°F, and a carbon dioxide level as high as 40 p.p.m. Striped bass 10 and 20 days old will tolerate pH levels of 10.2 and 10.5, respectively, for short periods of time, at this facility. Significant local fry production at the hatchery should increase fingerling production since stocking can be accomplished prior to pond water reaching a lethal temperature. Soybean meal yielded the highest quantity

of zooplankton; however, it did not yield the highest production of fingerlings. With this type fertilizer a zooplankton peak can be expected approximately 31 days after its application and the preferred period for fry stocking would be 24 days after fertilization, in lieu of 19 days. A further evaluation of production using only inorganic 20-20-5 fertilizer is warranted at this hatchery in view of the production obtained. The greatest variety of food organisms were produced where this type fertilizer was applied. Johnson grass hay will produce a peak zooplankton pulse in approximately 55 days. Fry stocking should be 44 days after its application to the pond. Chicken compost appears to produce a peak concentration about 50 to 53 days after its application. A preferred fry stocking period was decidedly 49 days after initial fertilization in lieu of fry stocking 16 days prior to this. (Conclusions)

14182. Usami, Shuzo. 1970. MODE OF LIFE OF THE ADULT MACKEREL IN THE SEA OFF KANTO DISTRICT - III. VARIANCE IN BODY SIZE COMPOSITION BY GRADE OF SEXUAL MATURITY. Bull. Tokai Reg. Fish. Res. Lab., No. 63, 17-28. In Japanese with English abstract.

The present report deals with considerations on the homogeneity of body size composition in respect to size-group (such as small, medium and large), fork length and age of Japanese mackerel (Scomber japonicus Houttuyn) taken from two areas off Kanto District, namely the Pacific coast of Boso Peninsula and the sea around the Izu Islands. The data used were from mackerel belonging to a specific fraction of the Pacific population in the sea off Kanto District for the period from 1961 to 1968. The following results were obtained: Within the population, there was a certain difference between years in the size composition, fork length and age. However, the difference in fork length was not sufficiently large to enable the mackerel population under discussion to be divided into smaller groups. A highly significant difference within years in fork length composition between shoals from two different sea areas leads to the conclusion that both shoals do not belong to the same population. From this, it is suspected that a group of adult fish, which do not belong to the wintering shoals aggregating in the coastal waters along the Boso Peninsula, may directly immigrate into the neighbouring waters off the Izu Islands; this migration being in the very early period of the wintering season, i.e. December to January. (Auth.)

14183. Usami, Shuzo. 1970. MODE OF LIFE OF THE ADULT MACKEREL IN THE SEA OFF KANTO DISTRICT - IV. CHARACTERS OF AGGREGATION AND ENVIRONMENTAL CONDITIONS (2). Bull. Tokai Reg. Fish. Res. Lab., No. 63, pp. 29-60. In Japanese with English abstract.

The aggregation of the adult mackerel shoals at the stage of sexual maturity seemed to have a close relationship with the presence of the special character at the sea bottom. As a rule it was common at the neighboring area of a continental cliff, banks and their surroundings, and the area more or less close to a bank. The major distributing area of the adult mackerel well coincided with the zone of water temperatures between 15°C and 20°C at 50 meters in depth, and the habitat of the mackerel was generally restricted to the inshore areas north of the Kuroshio. A relationship between the existing area of the adult mackerel and the vertical distribution of the water temperature was found that the fish was mainly living in a zone of moderate water temperatures ranging from 14°C to 19°C, notably between 15°C and 18°C. The relation was similar to the result obtained from the horizontal surveys of the 50 meter layer. And the existence of the adult mackerel had a very close relationship with the distribution of isothermal lines. No definite relationship was found between the abundance of the fish and the chlorinity of seawater, but adult mackerels were generally found within waters of higher chlorinity than 19.20 °/oo. (Auth.)

14184. Onishi, Toshio, and Shigeo Murayama. 1970. STUDIES ON ENZYMES OF CULTIVATED SALMONOID FISHES - II. ACTIVITIES OF PROTEASE, AMYLASE, ARGINASE, GPT (GLUTAMIC-PYRUVIC TRANSAMINASE) AND GOT (GLUTAMIC-OXALOACETIC TRANSAMINASE) IN VARIOUS GROWTH STAGES. Bull. Tokai Reg. Fish. Res. Lab., No. 63, 123-132. In Japanese with English abstract.

Following the previous report, enzyme activities were studied in various growth stages of salmonids (hime salmon, cherry salmon, rainbow trout and brook trout) reared on a commercial diet at Nikko Branch Station, Freshwater Fisheries Research Laboratory. Activities of protease and amylase were generally unaffected by change of body weight of the fishes, but were affected by maturation. The protease activity of the stomach for all species was highest in summer and lowest during the spawning season, in response to the amount of feeding. The protease activity of the pyloric caeca during the spawning season tended to increase in brook trout and cherry salmon, contrary to the decrease in hime salmon. The amylase activity of pyloric caeca from cherry salmon, rainbow trout and brook trout increased greatly at spawning time. It seems that hepatic arginase activity for all species increases in the male and decreases in the female with maturing. The hepatic GPT activity of fingerlings was found to be lower than in adults irrespective of the species of fish. The hepatic GOT activity did not differ much by species and growth stage. (Authors)

14185. Marmorino, Concetta, Virgilio Botte, and Giovanni Chieffi (Univ. of Camerino, Italy). 1969. THE BASOPHILE CELLS OF THE PITUITARY OF THE SYNCHRONOUS HERMAPHRODITE TELEOST Serranus hepatus IN THE COURSE OF THE SEXUAL CYCLE. (Le cellule basofile dell'ipofisi di Serranus hepatus, teleosteo ermafrodita sincrono, nel corso del ciclo sessuale). Pubbl. Staz. Zool. Napoli 37, pp. 389-393. In Italian.

The authors have shown two types of basophil cells in the pituitary of the synchronous hermaphrodite teleost Serranus hepatus. The first type is only PAS-positive, whereas the second is positive to alcian, paraldehyde fucsine and paraldehyde thyonine. Both basophils increase in number during spawning. These remarks agree with the results of cytological studies carried out on Serranus scriba. (Authors summ.)

14186. Pflieger, William L. 1971. A DISTRIBUTIONAL STUDY OF MISSOURI FISHES. Publ. Mus. nat. Hist. Univ. Kans., 20(3): 225-570, 15 figs. 193 maps.

Contents: Introduction; Historical review of ichthyology in Missouri; The environmental setting; Fish faunal regions of Missouri; Distribution of fishes in relation to environment; Cenozoic events affecting distribution of Missouri fishes; Developmental history of the fish fauna of Missouri and the Central Mississippi Valley; Accounts of species; Summary and conclusions; Acknowledgments; Literature cited; Distribution maps; Index to common and scientific names.

14187. Badawi, H. K. (Inst. of Oceanography and Fisheries, Alexandria, Egypt, UAR). 1971. ELECTROPHORETIC STUDIES OF SERUM PROTEINS OF FOUR Tilapia SPECIES (PISCES). Marine Biology, 8(2): 96-98.

The blood serum of 4 Tilapia species were analyzed electrophoretically for protein components, and the percentage of proteins in each fraction was determined. Sera from Tilapia nilotica Linnaeus, T. zillii Gervais, T. galilaea Artedi, and T. aurea (Steindachner) were studied. Characteristic protein fractions for each species were obtained. The species differed in the number of protein fractions and in the final mobilities; T. nilotica sera migrate 120 mm, T. zillii sera 95 mm, T. galilaea sera 90 mm, and T. aurea sera 118 mm. The mobilities for fractions 1 and 2 were similar for the 4 species' sera. Interspecific differences in the amount of protein occurred. Diet may be a major contributing factor to the variations observed in the amount of total protein. (Auth.)

14188. Krüger, F. (Biologische Anstalt Helgoland (Zentrale), Hamburg, Germany (FRG). 1971. MATHEMATICAL ANALYSIS OF COMBINED TEMPERATURE AND SALINITY EFFECT ON THE METABOLISM OF Tilapia mossambica (TELEOSTEI). [Mathematische Analyse der kombinierten Wirkung von Temperatur und Salzegehalt auf den Stoffwechsel von Tilapia mossambica (Teleostei)]. Marine Biology, 8(2): 147-153. In German with English abstract.

Job (1969 a, b) has presented experimental results on the influence of temperature and salinity on the rate of oxygen consumption in Tilapia mossambica. He

evaluated his results on the basis of the allometric function. The present paper analyses, in addition, the data obtained on the basis of the temperature function proposed by the present author. The parameters of this formula reveal that, in 50 and 100 % sea water, the curves for the lagarithmic values for the given body weights are parallel to each other; only the slope is different for the two salinities. In fresh water, the logarithmic temperature curves diverge. Job's results clearly demonstrate that it is not possible to explain the differences in the respiratory metabolism of this fish on the grounds of the energy expenditure for osmoregulation. The present author supposes that the differences found in the rate of respiration are caused by differences in the ionic composition of the internal milieu in the different salinities. (Auth.)

14189. Lantz, Kenneth E. 1970. AN ECOLOGICAL SURVEY OF FACTORS AFFECTING FISH PRODUCTION IN A LOUISIANA NATURAL LAKE AND RIVER. Louisiana Wild Life and Fisheries Commission, a Dingell-Johnson Project, Fisheries Bull. No. 6, 92 p.

This completion report covers the eight jobs of Dingell-Johnson Project F-11-R conducted in the Sabine River and Lac Des Allemands from July 1, 1964 through June 30, 1967. The objectives of this study were: (1) to establish quantitatively what types of aquatic areas are rich, average and poor in the production of fish and fish food organisms, (2) to determine what cycles occur in the kinds and abundance of plankton and bottom fauna and (3) to correlate these cyclic occurrences of fish food organisms with variance in fish production in the study areas. Four stations in the Sabine River, two above and two below the Toledo Bend Dam Site, were sampled monthly for plankton and water chemistries; quarterly for bottom fauna and annually for fish distribution to determine pre-impoundment conditions of the stream. Three stations in Lac Des Allemands were sampled monthly for water chemistries, plankton and bottom fauna and annually for standing crop values of fish per acre in this coastal lake. Monthly and seasonal comparisons between standing crop values and distribution of fish are compared to monthly and seasonal production of net and nanno plankton, bottom fauna and physio-chemical conditions of the two study areas. Water quality of the Sabine River was similar to that reported by earlier investigators. The water in Toledo Bend Reservoir should be of good quality if oil field brine releases in the drainage are not allowed to increase or are reduced through the use of injection wells. Lac Des Allmands was a freshwater lake during the winter of each year, but a brackish condition developed in late spring and persisted throughout each summer and fall. The development of the brackish condition coincided with a persistent blue-green algae bloom that prevailed from April through October of each year. The brackish condition probably influenced the movement of game and commercial fish between the lake and adjacent waters. Plankton production in the Sabine River began to increase by February of each year, but counts and weights of net and nanno plankton revealed sporadic high to low values from month to month without predictable trends toward summer maximum productivity. The lack of an extended period of high plankton density was associated with peak stream discharges. The two upper stations of the Sabine River exhibited higher seasonal numbers, volumes and weights of bottom organisms than found at the two lower stations. Maximum production of bottom fauna occurred each spring in the river. The two major benthic groups in Lac Des Allemands were Tubificidae and Chironomidae, with Chironomidae species being most abundant during peak occurrences of bottom fauna. A seasonal peak occurrence of larval Chironomidae occurred each summer, followed by an early fall buildup of the same group. Stomach samples of channel catfish in the summer and winter indicated a good utilization of Chironomidae larvae. Annual standing crop values of fish in Lac Des Allemands revealed a high poundage of channel catfish (three year mean of 87 pounds per acre), yet only 20 percent of this weight was of marketable size based on the present Louisiana limit of 13 inches total length. Consideration should be given to reducing the legal marketable size of channel catfish to 10 inches total length in Lac Des Allemands and similar coastal lakes of Louisiana. Collections of fish in the Sabine River indicate species of Centrarchidae and Cyprinidae were common in this drainage, with no major changes in fish populations from that

reported by earlier investigators. Data collected during the fish survey was used in recommending stocking only one native fish species following closure of the Sabine River to create Toledo Bend Reservoir. Largemouth bass fingerlings were stocked in the river in the spring of 1967 and non-native striped bass and walleye fingerlings were stocked in the springs of 1967 and 1968. (Auth.)

14190. Habener, Joel F., Frederick R. Singer, Leonard J. Deftos, Robert M. Neer, and John T. Potts, Jr. (Dept. of Med., Harvard Med. School and Mass. Gen. Hospital, Boston, Massachusetts). 1971. EXPLANATION FOR UNUSUAL POTENCY OF SALMON CALCITONIN. Nature New Biology, 232(29):91-92.

The calcitonins are polypeptide hormones of thirty-two amino-acids which lower serum calcium in mammals by inhibiting bone resorption. During evaluation of these hormones as a means of treating skeletal disorders in man, particularly Paget's disease of bone, the surprising observation was made that calcitonin from the salmon (SCT) is 20-200 times more potent than porcine calcitonin (PCT) and at least ten times more potent than human calcitonin. SCT is far more potent than any mammalian calcitonin yet tested in a wide variety of animal species. This unusual potency of salmon calcitonin could reflect either a greater hormone affinity for receptor sites or a greater resistance to metabolic destruction. Evidence is reported which supports the latter possibility, infused SCT disappears from the circulation of the dog much more slowly than does PCT.

14191. Lom, Jiri, and John O. Corliss (Dept. of Biol. Sci., Univ. of Ill. at Chicago, Illinois). 1971. MORPHOGENESIS AND CORTICAL ULTRASTRUCTURE OF Brooklynella hostilis, A DYSTERIID CILIATE ECTOPARASITIC ON MARINE FISHES. J. Protozool., 18(2): 261-281.

Morphogenesis and the cortical structures of Brooklynella hostilis, a cyrtophorine gymnostome ciliate ectoparasitic on marine fishes, were studied from protargol silver-impregnated preparations and with the aid of electron microscopy. The pattern of morphogenesis of Brooklynella is close to that found in less differentiated species of the families Chlamydodontidae (e. g., in the genus Trithigmostoma) and Dysteriidae (e. g., in the genus Hartmanula). The full number of kineties in the opisthe is restored after division from a segment of the left one of the 3 kineties producing the oral rows. The oral rows consist of a double row of kinetosomes arranged in a zig-zag pattern; only the outer row is ciliated, the inner one being barren. However, the positions of the postciliary and transverse fibers indicate that the oral rows are not homologs of an undulating membrane but are akin to a membranelle. In association with the ventral somatic kinetosomes there are 4 postciliary fibers; a rather aberrant, transversally oriented kinetodesma; 2 microtubular, transverse fibers plus a transverse fibrous spur; and one to several ribbons of subkinetal microtubular fibers. Not directly associated with the kinetosomes are fibrous strands running subpellicularly between the kinetosomes and also deep into the cytoplasm. The cortical structures of Brooklynella are compared with those of some other groups of ciliates of about the same phylogenetic level in which the subkinetal microtubules can also be found - rhynchodine, suctorian, and chonotrich ciliates. The nasse consists of 6-8 nematodesmata not closely associated with the microtubular cytopharyngeal tube. The former have a distinctly developed densely fibrous capitulum containing barren kinetosomes which originally produced the nematodesma during stomatogenesis; the capitulum is connected by a fibrous link to the microtubular shaft. Extending from the oral rows to the capitula are fibrous structures strongly reminiscent of filamentous reticulum in hymenostome and peritrich ciliates. The structure of the posterio-ventral glandular organelle is also described and discussed. (Authors synopsis)

14192. Pedersen, Roger A. (Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. DNA CONTENT, RIBOSOMAL GENE MULTIPLICITY, AND CELL SIZE IN FISH. J. Exp. Zool., 177(1): 65-78.

The diploid nuclear DNA contents in eight species of fish have been found to differ over a 178-fold range. Among these, lungfish have the highest values, and teleosts have the lowest. Shark and coelacanth have intermediate values, which

are close to the highest teleost values. Such great variation in DNA contents among vertebrates indicates that fundamental differences in chromosome structure and DNA function have arisen during evolution. In order to gain insight into the organization of genes in organisms with different DNA contents, the relative proportion of the genome coding for ribosomal RNA was determined for five species, winter flounder, goldfish, rainbow trout, dogfish shark, and Australian lungfish. The proportion of ribosomal DNA (r-DNA) was found to vary over a six-fold range from flounder to lungfish. In general, species with higher DNA contents have lower proportions of r-DNA. The r-DNA proportion of trout is consistent with the view that salmonids are recent tetraploids. If the goldfish is also considered a tetraploid, then its r-DNA proportion indicates a loss of ribosomal genes subsequent to polyploidization. Measurement of the ribosomal genes in fish DNA's was based on hybridization with yeast ribosomal RNA, which was assumed to be equally homologous with the r-DNA of all species studied. The activity of multiple copies of genes was studied by measuring the volumes of blood cells in five species. It was found that erythrocyte volume correlated both with ribosomal gene multiplicity and with total DNA content. The size of goldfish and trout erythrocytes suggests that cell volume in these tetraploids has declined to the ancestral diploid level. It is concluded that the multiplicity of specific repetitive genes varies out of proportion with the DNA content, contrary to expectation based on simple polyteny. This variation in the proportions of specific genes and the large variations in total DNA content among fish are thought to be due to a combination of tetraploidy and extensive linear replication of specific chromosomal regions during evolution. (Auth.)

14193. Pickford, Grace E., Anil K. Srivastava, Anna M. Slicher, and Peter K. T. Pang (The Bingham Lab., Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. THE STRESS RESPONSE IN THE ABUNDANCE OF CIRCULATING LEUCOCYTES IN THE KILLIFISH, Fundulus heteroclitus. I. THE COLD SHOCK SEQUENCE AND THE EFFECTS OF HYPOPHYSECTOMY. J. Exp. Zool., 177(1): 89-96.

When intact male Fundulus heteroclitus, adapted to 20°C in sea water, are subjected to three minute immersion at ca. 1°C they pass into a state of transitory coma from which they recover when returned to warm temperature. Hematological studies at recovery time intervals revealed an alternating sequence of leucopenia and leucocytosis that was not accompanied by corresponding changes in the abundance of erythrocytes, in serum chloride or total osmolality. The typical sequence was as follows: leucopenia at three minutes, leucocytosis at 15 minutes, leucopenia at 30 to 60 minutes, and leucocytosis at two hours. This was followed by a gradual return to normal. The major leucocytic cell type resembles a lymphocyte; the cycle was not accompanied by corresponding changes in the abundance of small or large lymphocytes, or in the abundance of eosinophils. Hypophysectomy abolished, or minimized, the second leucocytic phase, but the earlier phases of the cycle were unaffected. Serum glucose increased significantly in the second leucocytic phase. (Authors)

14194. Pickford, Grace E., Anil K. Srivastava, Anna M. Slicher, and Peter K. T. Pang (The Bingham Lab., Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. THE STRESS RESPONSE IN THE ABUNDANCE OF CIRCULATING LEUCOCYTES IN THE KILLIFISH, Fundulus heteroclitus. II. THE ROLE OF CATECHOLAMINES. J. Exp. Zool., 177(1): 97-108.

Intraperitoneal injections of distilled water at 5 µl/g, but not at 1 µl/g, elicit transitory leucopenia at three minutes post-injection in intact Fundulus heteroclitus. Later phases of the stress sequence (Pickford et al., '71) are not elicited. Intraperitoneal injections of epinephrine (0.025 µg/g in 5 µl/g H_2O) completely simulate the cold-shock leucocyte sequence. Hypophysectomy abolishes the two hour leucocytic phase, as in the cold-shock response. Norepinephrine is ineffective at 0.1 µg/g but simulates the epinephrine response at a high dose (1.0 µg/g). Isoprenaline (1.0 or 0.1 µg/g) elicits the leucopenic but not the leucocytic phases. Pretreatment with phenoxybenzamine (2.5 mg/liter aquarium water) abolishes both three minute and 45-60 minute cold-shock leucopenia; two hour leucocytosis is

unimpaired but the 15 minute response is reversed. Pretreatment with propranolol (1 μg/liter aquarium water) has no effect on the two leucopenic phases; two hour leucocytosis is delayed or, at higher doses, abolished; 15 minute leucocytosis is either unaffected, or reversed. It is not possible to interpret these results in terms of classical mammalian alpha- and beta-adrenergic mechanisms. (Authors)

14195. Pickford, Grace E., Anil K. Srivastava, Anna M. Slicher, and Peter K. T. Pang (The Bingham Lab., Dept. of Biol., Yale Univ., New Haven, Connecticut). 1971. THE STRESS RESPONSE IN THE ABUNDANCE OF CIRCULATING LEUCOCYTES IN THE KILLIFISH, Fundulus heteroclitus. III. THE ROLE OF THE ADRENAL CORTEX AND A CONCLUDING DISCUSSION OF THE LEUCOCYTE-STRESS SYNDROME. J. Exp. Zool., 177(1): 109-118.

The response of intact Fundulus heteroclitus to intraperitoneal injections of ACTH at two hours post-injection depends on the dose: leucopenia at low doses, leucocytosis at high doses. The two hour response to cortisol, at 5 μg/g, depends on the condition of the fish: leucocytosis in sexually mature or hypophysectomized fish, leucopenia in sexually regressed intact fish. At a physiological dose (0.025 μg/g) cortisol elicits a time sequence response in hypophysectomized recipients that is, initially, the reverse of that observed after cold-shock: three minute leucocytosis, 15 minute leucopenia, and return to normal at 45 minutes. Leucocytosis emerges at two hours. Pretreatment with Metopirone for five to six days in the aquarium water is not well tolerated. Such treatment effectively blocks all phases of the cold-shock response. Pretreatment for two days was tolerated and, in such fish, injection of epinephrine (1 μg/g) elicits both three minute and 30-60 minute leucopenia, but the leucocytic phases are blocked. A tentative interpretation of the cold-shock sequence is proposed on the assumption that catecholamines (presumably epinephrine) are leucopenic and that cortisol is leucocytic. (Authors)

14196. Sunaga, Tetsuo (Inst. of Biol., Fac. of Education, Kagawa Univ., Japan). 1970. RELATION BETWEEN FOOD CONSUMPTION AND FOOD SELECTIVITY IN FISHES. I. FOOD SELECTIVITY OF JUVENILE HASU (Opsariichthys unicirostris Teminck et Schlegel), IN LAKE BIWA. Jap. J. Ecol., 20(4): 129-137. (In Japanese with English synopsis).

The food selectivity of the juvenile Hasu (Opsariichthys unicirostris) was investigated in the summer of 1964, 1965 and 1966 at Omatsuzaki situated on the west coast of Lake Biwa, Shiga Prefecture. The fish specimens examined were caught with a small seine made of fine nylon mesh (2mm mesh), and simultaneously a series of quantitative sampling of zooplankton was done. The examination of the gut contents of the fish showed that they relied solely on zooplankton, especially Daphnia longispina, Diaphanosoma brachyurum and Mesocyclops leuckarti. Eodiaptomus japonicus, Leptodora kindti and Alona sp. played only a minor role, actually less than 5 percent in total and thus they were neglected. Although the biomass of D. longispina was always smaller than that of other plankters in the water the fish fed on D. longispina exclusively. D. brachyurum was fed on in a large quantity only in the case where a high biomass level was associated with an extremely low one of D. longispina. M. leuckarti was fed on only when both of the former species were scarce. The selectivity index E_i was employed to determine the grade of selectivity of each food organism, and the E_i value of each food organism fluctuates with the changes in the biomass level of all other plankters coexisting in the water. For example, the E_i of D. longispina usually took a high positive value, but the E_i of D. brachyurum took a positive value only when the former was very scarce. (Auth. synopsis).

14197. Kato, Mamoru. 1971. SEX RATIO, FECUNDITY AND MATURATION OF THE MASU SALMON, Oncorhynchus masou (Brevoort), DURING THE MARINE LIFE. Bull. Jap. Sea Reg. Fish. Res. Lab., No. 23, pp. 55-67.

Sex ratio and maturation of the masu salmon, Oncorhynchus masou (Brevoort), were studied using 3,710 specimens collected from offshore of the Japan Sea during spring seasons from 1965 to 1969. In addition, the number of ovarian eggs and egg diameter of 147 specimens caught in 1969 were examined. The results obtained

were as follows: 1) The proportion of females to total catches in each year ranged from 61 to 68 percent with 65 percent in the annual average. The sex ratio during the marine life was about two females to one male. Since the sex ratio in the natal times is approximately one to one, it is estimated that one-half of males stay in the natal streams throughout their whole life as "yamame". The proportion of females in the catches obtained by the gill net was a little more than that by long line. 2) The number of the ovarian eggs taken per female was given as 1, 200 to 5, 600, having 2, 600 eggs in the mean and 2, 300 eggs in the mode. 3) The mean gonad weight in early March was 1. 7g for males and 7. 4g for females, then the mean increased up to 10. 5g and 50. 9g in late May, respectively. The rise of their mean gonad index during the same period was given as 0. 2 to 0. 7 for males and 0. 9 to 3. 3 for females, respectively. It is estimated that maturation of males is accelerated slightly in late April or early May, and that of females progress gradually through March to May. However, maturation of both sex during the marine life has not advanced materially in comparison with that after entering into their upstream migration. 4) Ranges of the mode of the egg diameter in each specimen was 1. 1 mm to 2. 4 mm in March, 1. 3 mm to 4. 2 mm in April, and 2. 1 mm to 5. 1 mm in May, respectively. The regression between the mode of egg diameter (R) and the gonad index (G. I.) could be expressed by the formula, $G.I. = 0.32 R^2$. (Auth.)

14198. Moore, Donald, Harold A. Brusher, and Lee Trent (Bur. of Comm. Fish. Biol. Lab., Galveston, Texas). 1970. RELATIVE ABUNDANCE, SEASONAL DISTRIBUTION, AND SPECIES COMPOSITION OF DEMERSAL FISHES OFF LOUISIANA AND TEXAS, 1962-1964. Contributions in Marine Science, Vol. 15, pp. 45-70.

Demersal fishes were collected monthly with a shrimp trawl at 33 to 60 stations in 7 to 110 m (4-60 fath) between the Mississippi River Delta and the United States-Mexico border from 1962 through 1964. Catches were generally two to five times greater off Louisiana than off Texas, with the greatest differences occurring in the shallowest waters. Differences in total catches between stations within each depth off Texas and Louisiana, between day and night tows, and between years generally were not significant. Seasonal differences in catches were great off each coast. The greatest catches off Louisiana were made in the winter and summer, and those off Texas were in the summer and fall. The largest catches were made between 7 and 46 m (4-25 fath) depths off Louisiana, and 27 and 110 m (15-60 fath) depths off Texas. Atlantic croaker, Micropogon undulatus and longspine porgy, Stenotomus caprinus, constituted nearly half of the total catch. Atlantic croaker, longspine porgy, and seatrout, Cynoscion arenarius and sea catfish, Galeichthys felis, were most abundant off Louisiana; longspine porgy, Atlantic croaker, inshore lizardfish, Synodus foetens and silver seatrout, Cynoscion nothus, dominated the catches off Texas. (Authors)

14199. Tan, Y. T. (Trop. Fish Cult. Res. Inst., Malacca, Malaysia). 1971. PROXIMATE COMPOSITION OF FRESHWATER FISH - GRASS CARP, Puntius gonionotus AND Tilapia. Hydrobiologia, 37(2): 361-366. In English.

The proximate analyses of freshwater fish - grass carp (Ctenopharyngodon idellus), Puntius gonionotus and Tilapia (male hybrid) are compared. Dried meals from eviscerated freshwater fish contained 57. 36-75. 92% protein; 4. 48-31. 84% fat and 10. 68-22. 88% ash. The results indicate that Tilapia had a higher fat content than gonionotus and grass carp, the latter having the lowest fat content. The reverse is true for protein, ash and minerals like sodium, phosphorus and potassium. The composition of grass carp feeding on different diets, such as Hydrilla verticillata, Napier grass (Pennisetum purpurem) and tapioca leaves (Manihot utilissins) indicated only a slight difference in protein content but a significant difference in fat and ash. The tabulated results show that grass carp and goniotus were of higher nutritive value when compared to the Tilapia. (Auth. summ.)

14200. Wohlschlag, Donald E., and Joseph J. Cech, Jr. (The Univ. of Texas Marine Science Inst. at Port Aransas, Texas). 1970. SIZE OF PINFISH IN RELATION TO THERMAL STRESS RESPONSE. Contributions in Marine Science, Vol. 15, pp. 21-31.

At temperature ranges of 10-20 C and 20-30 C, respiratory rates were determined for groups of four fish, each selected into large and small size ranges. Oxygen consumption rates determined by use of a rotating chamber were analyzed by multiple regressions relating the log oxygen consumption rate to log weight, temperature and swimming velocity. Multiple, partial and simple correlations among these variables also were calculated. All calculations were for small, large and combined size ranges. Analyses for combined size groupings yielded partial regression coefficients in agreement with data previously published. Definite differences exist in regressions for small and large groups when calculated separately at the two temperature ranges: at the 10-20 C range the respiratory-weight coefficients are unusually low for both large and small groups; at the 20-30 C range the coefficient for only the large fish is low. Calculated oxygen consumption rates on a unit weight basis for small, large and combined sizes at zero activity and over each of the temperature ranges revealed inconsistencies. At 20-30 C the calculated oxygen consumption rates per unit weight for small fish were, as expected, above the rates for the large fish; at 10-20 C the calculated rates were disproportionately high for the large fish compared to the rates for the small fish. Among the simple and partial correlations relating oxygen consumption to weight, pronounced discrepancies between small fish (positive correlations) and large fish (negative correlations) occur only at the lower temperature range. The disproportionate differences in metabolism and the discrepancies among the correlations of oxygen consumption rates only at lower temperatures suggest strongly that there is an interaction among respiration, weight and temperature. (Authors)

14201. Haider, Gerhard . 1971. HEMATOLOGICAL STUDIES ON RAINBOW TROUT (Salmo gairdneri Richardson) IV. ERYTHROCYTE COUNT AND HEMATOCRIT. [Hämatologische Untersuchungen an Regenbogenforellen (Salmo gairdneri Richardson) IV. Erythrozytenzahl und Hämatokrit] . Hydrobiologia, 37(3-4): 457-472. In German with English summary.

The changes in red-blood-cell-count (RBC) and hematocrit were investigated on 191 rainbow trouts (Salmo gairdneri Richardson) aged from 1 to 3 years. The average number of erythrocytes increases with the age of the fish from 1, 37 mill/mm^3 in the yearlings to 1, 63 mill/mm^3 at an age of 3. Significant differences of the RBC in males and females exist at no time. Corresponding by the hematocrit rises from 31% to 33% during the same period. The RBC of not matured 2-years old fishes (F_2) shows a distinct periodicity throughout the year. The maximal amount of erythrocytes appears in March: 1, 62 mill/mm^3, the lowest in November: 1, 62 mill/mm^3. The hematocrit seems to be more compensated in the same group. At the beginning of the year the hematocrit rises from 28% to 32%, varies between 33% and 34% in October, and drops to 27% in November. (Auth. summ.)

14202. Palmisano, John J., and William T. Helm (Coll. of Fish., Univ. of Washington, Seattle, Washington). 1971. FRESHWATER FOOD HABITS OF Salvelinus malma (Walbaum) ON AMCHITKA ISLAND, ALASKA. BioScience, 21(12): 639-641.

The diet of Dolly Varden captured on Amchitka consisted of over 50 food items. Of 889 stream Dolly Varden collected, 714 (80%) had been feeding. Aquatic insects were present in 90% of the fish that had fed. Other food items were crustaceans (12%); fish and fish eggs (4%); and mollusks (2%). By volume, aquatic insects were dominant in 59% of the stomachs, crustaceans in 10%, and fish and fish eggs in 3%. Of 1567 lake fish captured, 1323 (85%) had been feeding. Aquatic insects were the most frequent food (70%), followed by crustaceans (50%), mollusks (15%), and fish and fish eggs (6%). By volume, aquatic insects were dominant in 46% of the stomachs, crustaceans in 34%, fish and fish eggs in 6%, and mollusks in 2%. Aquatic insects were the most frequent item in the diet of Dolly Varden on Amchitka, with dipterans the most common insects. The midge in its three life forms was by far the most common dipteran.

14203. Kott, E. (Dept. of Biol., Waterloo Lutheran Univ., Waterloo, Ontario, Canada). 1971. LIVER AND MUSCLE COMPOSITION OF MATURE LAMPREYS. Canad. J. Zool., 49(6): 801-805.

Lengths, weights, liver weights, and color of sea lamprey (Petromyzon marinus) from Cayuga Lake and Lake Superior and of American brook lamprey (Lampetra lamottei) were recorded. Liver and muscle of the sea lamprey samples were analyzed for fat, water, and protein content. American brook lamprey were analyzed only for fat and water content. In both populations of sea lamprey, male livers had a higher fat content and lower water content than female livers, but the protein content was similar in the sexes. The liver composition of the Lake Superior sample, which represented a sample of late migrants, was not significantly different from the liver composition of earlier spawners (Lake Cayuga sample). In both populations of sea lamprey there was no sexual difference in muscle composition; however, the muscle fat was reduced and the muscle water was elevated in the late migrants as compared to the earlier migrants. No sexual differences in the composition of either the liver or the muscle were found in American brook lamprey. Although the brook lamprey examined were early migrants both liver and muscle had a reduced fat content when compared to early sea lamprey migrants. Using Lake Cayuga data, the approximate composition of male sea lamprey liver at the start of the spawning migration was 20% fat, 50% water, and 15% protein. Comparable values for females were 5% fat, 75% water, and 15% protein. The muscle composition, of both sexes at the beginning of the migration, was 8% fat, 70% water, and 20% protein. (Auth.)

14204. Bailey, Jack E. (NMFS, Biol. Lab., Auke Bay, Alaska). 1971. OSMOREGULATORY CAPABILITY IN JUVENILE SOCKEYE SALMON (Oncorhynchus nerka). Canad. J. Zool., 49(6): 841-845.

The osmoregulatory capability of sockeye salmon (Oncorhynchus nerka) embryos and fry was tested at weekly intervals by exposing them for 5 days to seawater with a salinity of 29 °/oo. Juveniles that survived the 5-day test were considered to be euryhaline. The fry acquired a salinity tolerance in March 1968 when they were 64 days old and less than 35-40 mm long. The juvenile salmon retained the ability to survive direct transfer to seawater during the 12-month period following March 1968. (Auth.)

14205. Ogilvie, D. M., and J. N. Fryer (Dept. of Zool., Univ. of Western Ontario, London, Ontario, Canada). 1971. EFFECT OF SODIUM PENTOBARBITAL ON THE TEMPERATURE SELECTION RESPONSE OF GUPPIES (Poecilia reticulata). Canad. J. Zool., 49(6): 949-951.

When guppies which had been exposed for 10 min to a 300 mg/l dose of sodium pentobarbital were placed in a temperature gradient, their average selected temperature was observed to be about 6°C lower than that for untreated control fish. Although the selected temperature gradually increased with time, it was still about 2°C lower than the control value of 29°C 4 h after exposure to the drug. (Authors)

14206. Eichelberger, James W., and James J. Lichtenberg (Environ. Protection Agency, Water Qual. Office, Analytical Qual. Control Lab., Cincinnati, Ohio). 1971. PERSISTENCE OF PESTICIDES IN RIVER WATER. Environmental Science & Technology, 5(6): 541-544.

The persistence of 28 common pesticides in raw river water was studied over an eight-week period. Twelve organochlorine, nine organophosphorus, and seven carbamate pesticides were studied at a concentration of 10 μg/liter. No measurable degradation or chemical change was observed for the following organochlorine compounds: BHC, heptachlor epoxide, dieldrin, DDE, DDT, DDD, and endrin. Azodrin was the only organophosphorus compound that was stable throughout the study. All carbamate compounds were significantly changed after one week, and all but Baygon were completely lost after eight weeks. Where possible, the degradation or chemical conversion products of the pesticides were identified. (Authors)

14207. Whitt, Gregory S., William F. Childers, and Thomas E. Wheat (Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1971. THE INHERITANCE OF TISSUE-SPECIFIC LACTATE DEHYDROGENASE ISOZYMES IN INTERSPECIFIC BASS (Micropterus) HYBRIDS. Biochemical Genetics No. 5, pp. 257-273.

A combination of hybridization (in vivo and in vitro), immunochemical, and electrophoretic analyses reveals that both smallmouth bass, Micropterus dolomieui (Lacépède), and largemouth bass, M. salmoides (Lacépède), possess three homopolymeric lactate dehydrogenase (LDH) isozymes, A_4, B_4, and E_4. The retinal-specific E_4 isozymes of these two parental species possess different electrophoretic mobilities. The two bass species were hybridized to produce the interspecific F_1 hybrids. In addition, F_2 and F_3 hybrid generations were produced. The genetic data from these crosses indicate that the retinal-specific LDH isozyme is the product of a distinct nuclear gene (E locus) on an autosomal chromosome. This E gene appears to segregate independently of the gene for supernatant MDH. The LDH E gene is highly active in the bass neural retina and less active in other neural tissues. However, unlike in most teleosts, the bass LDH E gene also functions in such nonneural tissues as the heart and kidney. (Authors)

14208. Underdal, Bjarne, and Tore Hastein (Dept. of Food Hygiene, Vet. Coll. of Norway, Oslo, Norway). 1971. MERCURY IN FISH AND WATER FROM A RIVER AND A FJORD IN THE KRAGERO REGION, SOUTH NORWAY. Oikos, 22(1): 101-105.

From a river in South Norway the mercury concentration in samples of water and of fish of the families Salmonidae and Percidae has been determined by activation analysis. From the fjord into which the river runs species of Gadidae have been analysed. The mean mercury concentration in water was found to be 0.5 ng/g. In Salmonidae, Percidae and Gadidae species the mean concentration was 1.26 ± 1.88 mg/kg, 1.13 ± 1.83 mg/kg and 0.91 ± 0.65 mg/kg. Downstream a wood pulp factory the corresponding values were 3.58 ± 1.19 and 4.93 ± 1.02 mg/kg respectively for Salmonidae and Percidae. (Authors)

14209. Madan Mohan Rao, G. (Dept. of Zool., Sir Theagaraya College, Madras, India). 1971. INFLUENCE OF ACTIVITY AND SALINITY ON THE WEIGHT-DEPENDENT OXYGEN CONSUMPTION OF THE RAINBOW TROUT Salmo gairdneri. Marine Biology, 8(3): 205-212.

Standard and active rates of oxygen consumption of rainbow trout (Salmo gairdneri) acclimated and tested at 5° and 15°C in various salinities (fresh water to 30 °/oo S) were determined. The fish used in experiments ranged in weight from 23 to 196 g. The relation between body weight and metabolism is discussed. Lowest rates of oxygen consumption were obtained in 7.5°/oo S at both temperatures and at all levels of activity; maximum rates were obtained in 30°/oo S (with the exception of smaller fish at 15°C). Reduction in osmotic load/cost of osmoregulation is suggested as the probable cause for the lowest rate of oxygen consumption in 7.5°/oo S, a salinity isosmotic with the plasma of the fish. Increase in temperature results in increase of metabolic rate. However, this has no effect on the slope of the weight—metabolism regression line. In 30°/oo S at 15°C, the response at higher levels of activity seems to be size-dependent. The slope of the regression line (weight versus oxygen consumption) increases with increasing activity at 15°C; this is more pronounced in 30°/oo S. However, at 5°C, no significant statistical difference was observed between the slopes. The scope for activity was calculated. It was found to be lowest in 7.5°/oo S, and the scopes in fresh water and 15°/oo S were not different. The scope in 30°/oo S was high at 5°C but, at 15°C, a reduced scope was found for smaller fish; this is a reflection of the earlier observation that small fish were unable to survive in a high salinity/high temperature combination. (Auth.)

14210. Badawi, H. K., and M. M. Said (Inst. of Oceanog. and Fish., Alexandria, UAR). 1971. A COMPARATIVE STUDY OF THE BLOOD OF FOUR Tilapia SPECIES (PISCES). Marine Biology, 8(3): 202-204.

The blood of 4 species of Tilapia has been examined. Mean erythrocyte count and size, hemoglobin content, and hematocrit value varied markedly among the

species examined. A tendency towards a reciprocal relationship between the number of erythrocytes and their size was observed. In general, there is a correlation between the erythrocyte counts, hemoglobin content, and hematocrit value among the species examined. (Authors)

14211. Radha, E. (Zool. Lab., Univ. of Madras, Madras, India and Zool. Dept., Bangalore Univ., Bangalore, India). 1971. SOME NOTES ON THE POPULATION DYNAMICS OF THE MONOGENEAN GILL PARASITE Gastrocotyle indica. Marine Biology, 8(3): 213-219.

The fish Caranx kalla of different size groups (2 to 18 cm body length) is present during various calendar months of the year off the Madras coast (S. India). C. kalla displays a definite progressive shift in growth during successive months; the fish grows from 2 cm (September) to about 18 cm (August) over a period of 12 months. The highest (47%) or lowest (11%) incidence of a monogenean gill parasite Gastrocotyle indica has been observed in the C. kalla size groups 2.0 to 3.9 cm or 16.0 to 17.9 cm; however, the maximum specific density of 10.9 parasite/infested fish was observed in the size group 14.0 to 15.9 cm. Small fish (2.0 to 3.9 cm) carry only larvae (58/100 fish); larger hosts (4.0 to 5.9 cm) larvae (45/100 fish) and juveniles (8/100 fish); individuals of the 6.0 to 15.9 cm size group harbour larval, juvenile and adult stages of G. indica. Fishes of more than 16 cm carry only adult parasites. The level of parasitization is higher on the male hosts (30% incidence; 5 parasites/infested male) than on the females (25% incidence; 4 parasites infested female). The highest incidences of larval, juvenile and adult G. indica occur in September, February, and May, respectively; the parasite seems to live for 1 year. The host requires a period of about 8 months to acquire immunity against infestation by G. indica or copepod parasites. (Auth.)

14212. Ronald, A. P., and H. Tsuyuki (Fish. Res. Bd. Canada, Vancouver Lab., Vancouver 8, Brit. Columbia, Canada). 1971. THE SUBUNIT STRUCTURES AND THE MOLECULAR BASIS OF THE MULTIPLE HEMOGLOBINS OF TWO SPECIES OF TROUT, Salmo gairdneri AND S. clarki clarki. Comp. Biochem. Physiol., 39(2B): 195-202.

Salmo gairdneri and S. clarki clarki have nearly identical hemoglobin electrophoregrams. In both species, the two classes of hemoglobins, three fast and three slow, possess one allelic variant in the β-chains which appear singly or doubly in tetrameric combinations with the more electrophoretically invariant α-chains. Each of the three slow hemoglobins of S. gairdneri consist of an additional, possibly non-allelic, α-chain. Thus tetrameric structures with two, three, and four distinct chains are present. Interspecifically, the corresponding polypeptides are electrophoretically, but not necessarily sequentially, similar. In both species, the polypeptides from the slow and fast hemoglobins are different, indicating absence of hybridizations between the two classes of hemoglobins. Within each class of hemoglobins, in both species, the molecular species heterozygous to the β-chains yield the corresponding homozygous forms. The bases upon which homology between the α-chains of hemoglobins from mammalian and fish sources are tentatively established are discussed. (Authors)

14213. Johnson, Allyn G., Fred M. Utter, and Harold O. Hodgins (NMFS, Biol. Lab., Seattle, Washington). 1971. PHOSPHOGLUCOMUTASE POLYMORPHISM IN PACIFIC OCEAN PERCH, Sebastodes alutus. Comp. Biochem. Physiol., 39(2B): 285-290.

Three phenotypes of phosphoglucomutase were found in muscle extracts of Pacific Ocean perch (Sebastodes alutus) by starch gel electrophoresis. Evidence for nonrandom distribution of phenotypes with regard to depth at which samples were taken, sex and alleles of α-glycerophosphate dehydrogenase is presented. (Authors)

14214. Swedmark, M., B. Traaten, E. Emanuelsson, and A. Granmo (Kristinebergs Zoologiska Station; Fiskebackskil, Sweden). 1971. BIOLOGICAL EFFECTS OF SURFACE ACTIVE AGENTS ON MARINE ANIMALS. Marine Biology, 9(3): 183-201.

The biological effects of 5 surface active agents (the anionic ABS, LAS and LES 3 EO and the nonionic NP 10 EO and TAE 10 EO) on marine fishes, crustaceans and bivalves have been tested in continuous-flow systems. Concentrations from 100 to 0.5 ppm were normally used. Fishes were found to be more susceptible (96 h LC 50 range: 0.8 to 6.5 ppm) than bivalves (96 h LC 50 range: 5 to 100 ppm) while crustaceans were considerably more resistant (96 h LC 50 range: 25 to 100 ppm). Within each of these 3 systematic groups, more active species were found to be more sensitive than less active species. Developmental stages were also more sensitive than adults. The resistance of crustaceans to surfactants decreases immediately after moulting. The most toxic agent for fishes and decapods was the "soft" anionic LAS, and for bivalves and barnacles the "hard" nonionic NP 10 EO. Ability to recover normal behaviour after exposure decreases with increasing concentration and time, and ceases earlier in anionic than in nonionic surfactants. The first reaction to the surfactants is increased activity (avoidance reaction of mobile species), followed successively by inactivation, immobilization and death. Nonionic surfactants affect the equilibrium in fishes. Sublethal effects appear as impaired locomotory activity and breathing rate in fishes and crustaceans, impaired byssus activity and shell closure in Mytilus edulis, burrowing in Cardium edule, Astarte montagui and Astarte sulcata. Siphon retraction is affected in Mya arenaria and Cardium edule, as is also the response to food of the Leander spp. (Authors)

14215. Pantelouris, E. M., A. Arnason, and F. W. Tesch (Biol. Dept., Univ. of Strathclyde; Glasgow, Scotland, UK). 1971. GENETIC VARIATION IN THE EEL. III. COMPARISONS OF RHODE ISLAND AND ICELANDIC POPULATIONS. IMPLICATIONS FOR THE ATLANTIC EEL PROBLEM. Marine Biology, 9(3): 242-249.

The frequencies of certain electrophoretic fractions of esterases, transferrins and haemoglobins in an American sample of eels (Anguilla rostrata LeSueur) are compared to those in a sample from Iceland [A. anguilla (L.)]. A number of quantitative differences were established as well as 6 contrasts of a qualitative all-or-none type. The bearing of these differences and contrasts on theories concerning a separate or a single gene pool for Atlantic eels is discussed. (Authors)

14216. Livingston, R. J. (Dept. of Biol. Science, Fla. State Univ., Tallahassee, Florida). 1971. CIRCADIAN RHYTHMS IN THE RESPIRATION OF EIGHT SPECIES OF CARDINAL FISHES (PISCES: APOGONIDAE): COMPARATIVE ANALYSIS AND ADAPTIVE SIGNIFICANCE. Marine Biology, 9(3): 253-266.

A comparative study was made of the entrained (12:12 LD) and endogenous (DD) respiratory rhythms of 8 species of cardinal fishes. Volumetric respirometers, designed specifically for long-term measurements of oxygen uptake by small fishes under controlled conditions, were used during standard 5 day experiments. Despite some individual variation, certain species-specific and genus-specific patterns of respiration emerged. Each species showed a persistent (advancing) rhythm of oxygen consumption during 3 days of DD. Light appeared to be the "Zeitgeber", with the light-dark transition phasing the nocturnal peaks and the dark-light transition possibly phasing the diurnal ones. Genus-specific and species-specific trends in field behavior, habitat selection, and distribution were studied. There was correlations between the field behavior and the entrained respiratory rhythms of these nocturnally active fishes. Entrained and endogenous rhythms of each species showed characteristic similarities and were interpreted as integral components of a level of organization evolved for nocturnal life in the shallow marine environment. (Auth.)

14217. Pitombeira, M. S., F. V. Barreto Gomes, and J. M. Martins (Lab. de Ciencias do Mar and Faculdade de Medicina da Univ. Fed. do Ceara, Fortaleza, Seara, Brazil, South America). 1971. RED BLOOD CELL OSMOTIC FRAGILITY IN THE SPANISH MACKEREL Scomberomorus maculatus. Marine Biology, 9(3): 250-252.

Red cell osmotic fragility was studied in 50 blood samples of the fish Scomberomorus maculatus (Mitchill). High levels of mean corpuscular fragility were found and hypotheses are presented to explain this phenomenon. (Authors)

14218. Shatton, Jennie B., John E. Halver, and Sidney Weinhouse (Fels Res. Inst., and Dept. of Biochem., Temple Univ. School of Medicine, Philadelphia, Pennsylvania). 1971. GLUCOSE (HEXOSE 6-PHOSPHATE) DEHYDROGENASE IN LIVER OF RAINBOW TROUT. J. Biol. Chem., 246(15): 4878-4885.

Liver of the rainbow trout and other salmonid fish contains a highly active glucose dehydrogenase which is also active toward glucose-6-P, galactose-6-P, 2-deoxyglucose-6-P, xylose, and galactose. It resembles one of the rat liver hexose-6-P dehydrogenase isozymes in its broad substrate specificity and its electrophoretic migration on starch gel; but differs in some kinetic properties. The enzyme, purified approximately 200-fold, is more active toward glucose than toward glucose-6-P at pH 7.4, but is less active toward glucose than glucose-6-P at pH 10. K_m for glucose is 20 to 80 mM, depending on the pH; and for glucose-6-P it ranges from 0.01 to 0.1 mM. Over the pH range of 6.5 to 10.5 the glucose dehydrogenase activity is about the same for NAD^+ or $NADP^+$ as coenzyme, but Mg^{2+} ions are required with $NADP^+$. The enzyme is much more active with $NADP^+$ than NAD^+ with glucose 6-phosphate as substrate, but activity with $NADP^+$ is inhibited by Mg^{2+}, whereas activity with NAD^+ is unaffected. The enzyme appears to be equally divided between the particulate and soluble fractions. Trout liver also contains two other electrophoretically distinguishable glucose-6-P dehydrogenases, but which differ from this enzyme in their inactivity toward NAD^+ and glucose. (Authors summ.)

14219. Walker, M. Greer (Fish. Lab., Lowestoft, Suffolk, England). 1971. EFFECT OF STARVATION AND EXERCISE ON THE SKELETAL MUSCLE FIBRES OF THE COD (Gadus morhua L.) AND THE COALFISH (Gadus virens L.) RESPECTIVELY. Journal du Conseil, 33(3): 421-426.

Following starvation for 130 days the body weight of cod decreased by 30%, the diameter of the red muscle fibres by 15% ($P < 0.001$) and that of the white muscle fibres by 40% ($P < 0.001$). Coalfish swimming continuously for 42 days at a speed of 0.93 body length (L/sec) showed no change in weight compared with controls but the red fibres increased in diameter by 55% ($P < 0.001$). There was no significant change in diameter of the white fibres. At 2.01 L/sec both the red and white fibres of coalfish increased in diameter (by 61% and 32% respectively, $P < 0.001$ in both cases) although the body weight decreased by 13% compared with the controls. (Auth.)

14220. Yap, H. H., D. Desaiah, L. K. Cutkomp, and R. B. Koch (Dept. of Entomology, Fisheries and Wildlife, Univ. of Minn., St. Paul, Minnesota). 1971. SENSITIVITY OF FISH ATPASES TO POLYCHLORINATED BIPHENYLS. Nature, 233(5314): 61-62.

The activity of the ATPase enzyme system in homogenized and fractionated tissues of the blue gill fish Lepomis machrochirus was examined, because this system is sensitive to DDT and related compounds and because distinctive differences in effect have been found among cyclodiene-type chlorinated hydrocarbons. Three PCB preparations, 'Aroclor 1221', 'Aroclor 1254' and 'Aroclor 1268', and one polychlorinated terphenyl, 'Aroclor 5460' (Monsanto) were used. All compounds inhibited ATPases in low concentrations (less than 1 p.p.m.) with the most pronounced inhibition on Mg^{2+} ATPase of muscle. 'Aroclor 1254' was the most effective inhibitor of ATPases, especially Mg^{2+} ATPase, from all tissues. 'Aroclor 1268', an effective inhibitor of muscle Mg^{2+} ATPase differed from the other PCB compounds in having minimal effects on Mg^{2+} ATPase activity from other tissues. 'Aroclor 5460' seemed to be intermediate between 'Aroclor 1268' and the other 'Aroclor' compounds in its effect on Mg^{2+} ATPase activity. The variation between tissues, most prominent with 'Aroclor 1268', indicates that the characteristics of Mg^{2+} ATPase differ depending on tissue source. A 30-40% inhibition of Na^+-K^+ ATPase measured only on brain and kidney preparations was consistently determined

for all PCBs. In general, the PCB preparations do not reveal any obvious relationships between percentage chlorination and inhibitory effects. But the differences in action of 'Aroclor 1268' on Mg^{2+} ATPase from different tissues and the similarities in effects between PCBs and DDT require further study.

14221. Arnott, H. J., J. A. C. Nicol, and C. W. Querfeld (Dept. of Botany and Cell Res. Inst., Univ. of Texas at Austin, Texas). 1971. REFLECTING SPHERES IN THE EYES OF WEAKFISHES (SCIAENIDAE). Nature, 233(5315): 130-133.

A reflecting layer or tapetum lucidum occurs in the eyes of many fishes; in teleosts, it lies in the pigment epithelium. The reflecting material is usually considered to be guanine, but in weakfishes or seatrouts (Sciaenidae) it is a lipid. Upon gas-liquid chromatographic examination, a sample showed some minor peaks corresponding to various methyl esters of fatty acids from C14 to C22:5, and one major peak corresponding to n-C22:6. The latter comprised 95% or more of the fatty acids present. It was concluded that the reflecting material consisted largely or almost exclusively of tridocosahexaenoin.

14222. Overstreet, Robin M. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1971. Glaucivermis spinosus Gen. et Sp. N. (DIGENEA: ZOOGONIDAE) FROM THE SOUTHERN KINGFISH, Menticirrhus americanus (Linnaeus), IN THE COASTAL WATERS OF MISSISSIPPI. J. Parasit., 57(3): 536-538.

Glaucivermis spinosus is described from the intestine and pyloric caeca of Menticirrhus americanus collected near Ocean Springs, Mississippi, in the Gulf of Mexico and adjacent waters. The genus is characterized primarily by having a preacetabular intestinal bifurcation, a preacetabular sinistral genital pore, a bilobed vitellarium, a swelling of Laurer's canal to form the seminal receptacle, and tandem to diagonal testes. It is most similar to the genus Diphtherostomum from which it differs primarily in the arrangement of the testes. (Auth.)

14223. Jewell, William J. (Water Poll. Res. Lab., Stevenage, England). 1971. AQUATIC WEED DECAY: DISSOLVED OXYGEN UTILIZATION AND NITROGEN AND PHOSPHORUS REGENERATION. J. Wat. Poll. Contr. Fed., 43(7): 1457-1467.

Decomposition kinetics of harvested aquatic weeds were determined under dark, aerobic laboratory conditions. The rate of decay averaged 9 percent/day, while 24 percent of the organic matter was refractory, that is, remained after 3 months of decomposition. Oxygen utilization for stabilization of the easily degradable fraction approximated 1.0 mg/mg organic material. The oxygen uptake rate was twice that reported for phytoplankton and half that of domestic waste. Nitrogen and phosphorus regenerations averaged 50 and 73 percent, respectively, but the range was 0 to 100 percent for both nutrients. By accounting for the nutrients remaining in the refractory organics, mathematical models could be used to predict all conditions varying from zero to complete regeneration. The kinetics developed in this study may be used to determine the ultimate impact of killing aquatic weeds on both standing and flowing waters. (Auth.)

14224. Aler, Gudrun M. (Dept. of Zool., Univ. of Stockholm, Sweden). 1971. THE STUDY OF PROLACTIN IN THE PITUITARY GLAND OF THE ATLANTIC EEL (Anguilla anguilla) AND THE ATLANTIC SALMON (Salmo salar) BY IMMUNOFLUORESCENCE TECHNIQUE. Acta Zoologica, 52(1): 145-156.

The prolactin containing cells in the Atlantic eel and the Atlantic salmon have been localized by fluorescein-labelled antibodies to ovine prolactin. Two fluorescence-methods have been used: the direct and the indirect. Erythrosinophilic cells in the follicles of the rostral pars distalis were stained by the fluorescent antibodies in both eel and salmon. Eels from brackish water were transferred to fresh or salt water and differences in the contents of prolactin in the hypophyses were tested. Attempts were made at a semi-quantitative estimation of prolactin, using a fluorescent antibody technique. Eels, which had been kept for three days in fresh water contained a smaller quantity of prolactin in their hypophyses, than the eels which were kept in salt water. (Auth.)

AUTHOR INDEX FOR VOLUME 16

Aass, Per, 13559, 13699
Abbott, F. S., 13236
Abdel-Magid, A. M., 13239
Abe, Isao, 13223
Abel, R., 13163
Abelson, Philip H., 13364
Abram, F. S. H., 13474
Acara, A. H., 13876
Ackefors, H., 13578, 14175
Ackman, R. G., 13444
Acres, O. E., 12886
Acton, R. T., 13786, 13888
Addison, W. D., 13287
Adron, J. W., 13716, 14040
Agrba, M. A., 13913
Ahlbert, Inga-Britt, 13392
Ahlstrom, Elbert H., 13159
Aitken, A., 12960
Akagawa, Mieko, 13760
Aker, E., 13184
Akiyama, Akio, 13232
Alabaster, J. S., 12858
Albers, R. J. A. M., 13190
Alderdice, D. F., 13934, 14036
Aler, Gudrun M., 14224
Alexander, R. McN., 13374
Al-Kholy, A., 13165
Allanson, B. R., 13475
Allen, Donald M., 13008
Allen, John L., 13036, 14149
Allen, K. Radway, 12967, 13445
Allen, Kenneth O., 12976, 13004, 13964
Alley, Wayne P., 13593
Allison, Terry C., 14140
Alt, Kenneth T., 13571
Altukhov, Yu. P., 12998
Amelink-Koutstaal, J. M., 13738
Amend, Donald F., 12988
Ames, Warren E., 13352
Anders, F., 13704
Anderson, Bobby T., 13299
Anderson, Emory D., 13516, 13892
Anderson, J. M., 13576
Anderson, R. Stewart, 13615
Anderson, V. M., 12957
Ando, Kazuo, 13757
Andrews, Austin K., 13253
Andrews, C. W., 13237
Androsyuk, L. Ya., 13673
Angiolelli, R. F., 13477
Anokhina, L. E., 13391
Anonymous, 13458, 13602
Antychowicz, J., 13357, 13946
Anwar, M., 13949
Aoe, Hiroshi, 13223
Aoki, T., 14174
Apostolski, K., 14009
Arai, Hisao P., 13939
Arai, Ken-ichi, 13214, 13216, 13219, 13228
Arai, Shigeru, 13273
Arakelova, A. L., 13467, 14121
Arcarese, G., 13660, 13851
Arcimowicz, B., 13608
Armour, Carl Lee, 13944
Armstrong, F. A. J., 13587, 13590
Armstrong, James G., 13910
Armstrong, Robert H., 13550
Arnason, A., 13607, 14215
Arnold, Jesse C., 14151
Arnott, H. J., 14221
Aron, William I., 14063
Arru, E., 13661
Arsan, O. M., 13763
Asakawa, Makio, 13209
Asano, Masahiro, 13986
Asano, Shoji, 13071, 13905
Ashley, Laurence M., 13988
Atherton, W. D., 12960
Atlantic Salmon Association, 13563
Avault, James W., Jr., 13004, 13504, 13549, 13964, 14142
Averett, Robert C., 14058
Avtalion, R. R., 13823

Babcock, W. H., 13178
Bache, C. A., 13767
Badawi, H. K., 14187, 14210
Badenko, L. V., 13673
Bagenal, T. B., 13478
Bahr, Thomas G., 13773
Bailey, George S., 13453
Bailey, Jack E., 14204
Baker, Claude D., 13244
Baker, Myron Charles, 13201
Baker, Phillip H., 13325
Bakkala, Richard G., 13853
Balakrishnan, K. P., 13044
Ball, H. J., 13485
Ball, Robert C., 13542, 13773
Balsiger, James W., 13160
Banarjee, S. C., 12975
Bane, Gilbert, 13990
Banks, J. W., 14074
Banks, Joe L., 13295
Bara, Gonül, 13407
Baranova, V. P., 12825
Barashkov, G. K., 13461
Barber, Willard E., 13547
Barbier, B., 13401
Barica, Jan, 13937
Barnick, J. A., 13801
Baroncelli, V., 14103
Baronkin, O. F., 13144
Barrett, Izadore, 12937
Bartel, Ryszard, 14000

Bartnik, Victor G., 13334
Bartsch, A. F., 14161
Basedow, Thies, 13069
Bason, William H., 12873
Bates, Daniel W., 13365
Bates, John M., 13852
Batychkov, G. A., 13669
Bauer, O. N., 13381
Baum, E. T., 13938
Bayeva, G. D., 13144
Bayliff, William H., 14025
Bays, L. R., 14165
Beach, S. A., 13487
Beardsley, Grant L., 14051
Beaumariage, Dale S., 14162
Bechtel, Timothy J., 13951
Becker, C. D., 13666, 13733, 13737
Beckett, J. S., 12866, 13770
Bedell, Gerald W., 13301
Beeston, Michael D., 13954
Beiningen, Kirk T., 12786, 13883
Bell, Gordon R., 13086
Bell, Henry L., 14014
Bell, W. H., 13490
Bellinger, John W., 14142
Belyayev, V. V., 13681
Belyy, N. D., 14128
Bender, Michael E., 13725
Bennett, David H., 13726
Bennett, Harry Jackson, 13472
Bennett, J. Claude, 13888
Bennett, M. S., 14105
Benoit, D. A., 13931
Benson, Norman G., 14018
Bentley, P. A., 13580
Berg, Andre, 13629, 13630
Berg, Ronald J., 13426
Berhaut, J., 13717
Bern, Howard A., 13705
Bernatowicz, Stanislaw, 13729
Berner-Samsonov, E., 13824
Berra, Tim M., 12800
Berval'd, E. A., 13461
Beyerle, George B., 13177
Bida, Gerald, 13376
Billard, R., 13402
Bilton, H. T., 13867, 14034
Birdsong, Charles L., 13504
Bishop, Frank G., 13294
Bitekhtina, V. A., 13523
Bjornn, T. C., 14135
Blahm, Theodore H., 13792, 14169
Blair, A., 13716, 14040
Blaylock, B. G., 13300
Bligh, E. G., 13943
Bloomfield, Richard A., 13778
Blunt, C. E., Jr., 13598, 13898
Bogdanova, L. S., 13148
Bogoroditskii, P. V., 13359
Bogoyavlenskaya, M. P., 13020
Bohl, Martin, 14117
Bok, A., 13475
Bolis, L., 14103
Bond, C., 13427
Bonnet, B., 13717,
Bonnet, L., 13401
Booke, Henry E., 13777
Booth, Gary M., 13955
Boothby, Rea N., 13549
Borisov, V. M., 13668
Bortone, Stephen A., 13573
Botte, Virgilio, 14185
Bottroff, Lawrence J., 13319
Bounds, R. L., 13304
Boush, G. M., 13815
Boyd, Claude E., 12804, 13131
Boyer, R. L., 13305
Braem, Robert A., 13254
Braithwaite, H., 13155
Brashear, D. A., 13801
Brauhn, James L., 13968
Braun, K., 13029
Breder, Charles M., Jr., 13479
Brett, J. R., 13099, 13621, 13768
Bridges, David W., 13730
Brinkley, H. J., 13167
Bross, Michael G., 13318
Broughton, E., 13625
Brown, Bradford E., 12803, 12845, 12862, 13039, 13063, 13064, 13067, 14094
Brown, C. J. D., 12939
Brown, Charles E., 13410
Brown, Clinton E., 12832
Brown, Edward H., 12948
Brown, Edward H., Jr., 13047
Brown, Elise A. B., 14046
Brown, George W., 13011
Brown, V. M., 13397, 13807
Brownell, Willard N., 13105
Brubaker, Paul E., 12993
Brungs, William A., 12795
Brunskill, G. J., 13584, 13596
Brusher, Harold A., 14198
Brusven, M. A., 13813
Bryan, G. W., 13577
Buhler, Donald R., 12922
Bulkley, Ross V., 12794, 13862
Bullis, Harvey R., Jr. 12928
Bulow, Frank J., 13349, 13889
Bumgarner, Daniel H., 13310
Burbank, Nathan C., Jr., 13501
Burkett, Robert D., 13200
Burmakin, E. V., 12963
Burns, James W., 13316, 13326, 14156
Burrell, Victor G., Jr., 13993
Burress, Ralph M., 13130
Burrows, Roger E., 13503
Burton, Boye H., 13471
Burton, Dennis T., 13313, 13322
Burton, William, 13104

Buss, Keen, 12986, 13500
Butler, David G., 14080
Butler, P. A., 13421
Butler, P. J., 14087, 14088
Buzakova, A. M., 13761
Byerly, Theodore C., 13614

Cagle, Jimmy B., 13215
Caillouet, Charles W., Jr., 13267
Cairns, John, Jr., 13168, 13288, 13692, 13852, 13904, 13996, 14045, 14151
Cala, Plutarco, 13556
Calaprice, J. R., 13480, 13489, 13620
Cambar, Roger, 13657
Cameron, James N., 13241, 13784
Camp, Bennie Joe, 13944
Campbell, A. D., 13493
Campbell, J. Scott, 13627
Campbell, K. Perry, 13566
Campbell, R. N., 13164
Campbell, Robert S., 13424
Candido, E. P. M., 14168
Cardwell, Rick D., 13783, 14091
Carey, Francis G., 13770
Caribbean Research Institute, 13894, 13895
Carlisle, John G., Jr., 13897
Carlson, Frank T., 13983
Case, Brian, 13107
Castagna, M., 13238
Cech, Joseph J., Jr., 14200
Ceretto, F., 13661
Chakrabarti, P. C., 12975
Chambers, James R., 14047
Chambolle, Pascal, 13657
Chapman, D. W., 13175
Charlon, Nicole, 13401
Chatterton, K., 13879
Chau, Yiu-Kee, 13203
Chen, Carl W., 13907
Chen, F. Y., 13337
Chen, Hon-cheng, 13920
Chenoweth, Stanley B., 13108
Chernova, Ye. G., 13680
Chernyshov, V. I., 13535
Chervinski, J., 14010
Chiang, W., 13945
Chiang, Wan, 13923
Chiarelli, B., 13051
Chichester, C. O., 13265, 13270
Chieffi, G., 13405, 14185
Chien, Shih Ming, 12930
Chigirinskiy, A. I., 14122
Chikova, V. M., 13138
Child, A. R., 14021
Childers, W. F., 14057, 14207
Chittenden, Mark E., Jr., 14067
Chitty, N., 13187
Choquette, L. P. E., 13625
Christensen, G. M., 13109
Christmas, J. Y., 12885
Chubba, Joseph V., 13414
Chuvatova, A. M., 13018
Cimino, Michael C., 13564
Cisar, J. O., 12840
Clark, A. S., 13874
Clarke, W. Craig, 14080
Clem, L. W., 13242
Cleugh, T. R., 13583
Coastal Plains Center for Marine Development Services, 13890, 14075
Coble, Daniel W., 14139
Cohen, Daniel M., 13324
Cohen, Mable, 13064
Cole, Charles F., 13353
Collette, Bruce B., 13492
Colley, L., 13787
Collins, Melvin D., 13985
Conover, Kelly R., 12977
Conrad, John F., 13005
Cooke, R. A., 13490
Cooper, Al, 13612
Cooper, Edwin L., 12949, 14011
Cooper, James A., 14154
Copeland, B. J., 13951
Coppage, David L., 13385
Cordone, Almo J., 13075, 13315, 13325
Corliss, John O., 14191
Courtenay, Walter R., Jr., 12968
Coutant, Charles C., 12978, 13666, 13731
Cowell, Bruce C., 13041
Cowey, C. B., 13716, 14040
Craig, P., 13129
Craig, Ronald C., 13689
Craven, Richard E., 13039, 13063, 13067
Crawley, Henri D., 12987
Crear, David, 13161
Cronin, Eugene L., 12925
Crossman, John S., 13692
Crossland, N. O., 14105
Cunningham, R. K., 12880
Cushing, C. E., 13731
Cushing, D. H., 14109
Cutkomp, L. K., 14220

Dacre, J. C., 13994
Dahlberg, Michael D., 14013
Daly, James J., 14100
Dandy, J. W. T., 12821
Dang, Le Dung, 12923
Davies, Ronald W., 13871
Davis, Clarence W., 13974
Davis, James T., 13070
Davis, John C., 12831, 13103, 13241
Davis, Robert M., 13710, 13866
Davis, W. P., 13719
Davis, William E., 13979
Davy, F. B., 12957
Dawley, Earl M., 13193

Dawson, C. E., 13250
Day, Donald, 13333
Day, John W., Jr., 13472
Deacon, James E., 13084, 13976
Dean, Robert B., 14065
Dechtiar, Alex O., 13739
Deftos, Leonard J., 14190
DeGiusti, Dominic L., 14100
DeGroot, S. J., 13998
Dekhnik, T. V., 13134
deKinkelin, P., 13402
Dembczynski, J., 13608
Dembinski, W., 14108
Dempster, Robert P., 13195
Dendy, J. S., 13082
Denoncourt, Robert F., 12873
Denton, Eric, 13332
Derse, Philip H., 13170
Desaiah, D., 14220
Deschamps, Gene, 13281
Desrochers, R., 14101
Detwyler, R., 13432, 13982
Duefel, Josef, 13652
Devi, C. B. Lalithambika, 13044
DeVries, Arthur L., 14177
Dewberry, F. Lawrence, 13782
Dickson, I. W., 13878
Dickson, Kenneth L., 13692, 13904, 14151
Didgeon, Bonny, 13131
DiDonato, Gene, 13284
Dixon, Gordon H., 13028, 13114, 13243, 14168
Dmitrenko, Ye. M., 13526
Dmitrenko, Yu. S., 12912
Dodd, J. M., 12900
Dodge, Douglas P., 13553
Dodgen, Charles L., 13072
Dominy, C. Leslie, 13667
Donaldson, Edward M., 12864, 12869, 13346, 13347, 13394, 13396
Dontsova, G. V., 12906
Dooley, Thomas P., 13502
Doroshev, S. I., 13465, 13668
Dorozhkina, T. Ya., 13149
Douglas, Philip A., 14023
Dove, G. Robert, 13252
Dovel, William L., 13701
Dragovich, Alexander, 12793, 13984
Drew, H. R., 12877
Drummond, R. A., 13172
Drury, Donald E., 12972
Druzhinin, A. D., 13671, 14120
Dryfoos, Robert L., 13707
Duckett, C. R., 13706
Duffy, J. Regis, 12812, 13120
Duka, L. A., 13134
Duke, T. W., 12894
Dunst, Russell C., 12980
Dupree, H. K., 13786
Durkin, Joseph T., 13496
Durum, W. H., 13581
Dyson, E. D., 13487

Eales, J. G., 13429, 13732, 14066
Earnest, Russell D., 13296
Eaton, John G., 13398
Eaton, Stephen W., 13574
Ebel, Wesley J., 12786, 12787, 13193 13925
Eberhardt, L. L., 13263
Ebert, Earl E., 13691
Eckroat, Larry R., 14147
Eckstein, Benjamin, 13774
Edelhauser, Henry F., 13782
Edmunds, James R., IV, 13701
Edsall, Thomas A., 12948
Edwards, Clive A., 13997
Edwards, Gary B., 13311
Edwards, George D., 13601
Edwards, Peter, 13083
Egusa, Syuzo, 13211, 13269, 13842, 14174
Ehira, Shigeo, 13208, 13229
Ehrlich, Karl F., 13049, 13327
Eichelberger, James W., 14206
Eisan, J. S., 13113, 13393
Elias, A. N., 13610
Ellefson, Paul V., 13711
Ellender, R. D., 13944
Eller, Lafayette L., 13980
Elliott, G. V., 13351
Elliott, Joseph W., 13295
Ellis, James N., 12808
Ellis, Robert J., 12788
Ellory, J. C., 14085
Elson, K. G. R., 12810
Emanuelsson, E., 14214
Emig, John W., 13597
Engashev, V. G., 13363
Engstrom-Heg, Robert, 13860
Ennis, G. P., 12946, 13335
Erman, Ye. Z., 13529, 13678
Ernst, W., 12917, 12918
Esch, Gerald W., 14112
Eslami, A. H., 13949
Espinosa, F. A., Jr., 13084, 13976
Essbach, Alban R., 13966
Etnier, David A., 13199
Evelyn, T. P. T., 13868

Fagade, S. O., 13476
Fagerlund, Ulf H. M., 12869, 13346, 13347, 13394
Fagerstrom, A., 13560, 13695, 13696
Fahay, Michael P., 12966
Fairbanks, Michael B., 13742
FAO of the UN, 13081, 13260, 13744, 13745, 13908, 13927, 13961, 14022, 14064, 14069, 14086

Farris, David A., 13049, 13327
Fast, Arlo W., 12996, 13567, 13887
Favreau, M. B., 13236
Federal Water Quality Administration, 13186
Federova, L. S., 13467, 14121
Fedoruk, Alex N., 13829
Feldmeth, C. R., 13351, 13901
Fenderson, O. C., 13866
Fenner, Richard B., 13896
Fenwick, James C., 13404
Ferguson, Denzel E., 13366
Fernando, C. H., 12824, 13616, 13766
Fertig, Daniel S., 13593
Fielding, S., 13053
Fink, Bernard D., 14025
Finley, Mack T., 13366
Finnin, Barrie C., 13370, 13375
Fisher, W. K., 13192
Fisheries Research Board of Canada, 13882
Flain, M., 13016
Flannagan, John F., 13104
Flemer, David A., 12872
Fleming, W. R., 12955, 13448
Fletcher, G. L., 14028
Fleyshman, D. G., 14132
Floyd, Hilton M., 13541
Fontaine, Maurice, 14068
Fontana, F., 13051
Ford, J. S., 13490
Forrest, A., 14021
Forrester, C. R., 13934, 14036
Forster, William O., 13057
Forward, Richard B., Jr., 13027
Foster, Neal R., 14045
Foster, W. A., 13750
Fowler, Laurie G., 13295, 13503
Fragala, R. J., 13940
Fraizier, A., 14041
Frame, David W., 12997
Franks, James S., 12884
Frantz, Ted C., 13325
Fraser, N. W., 13800
Fraser, Thomas H., 14082
Fredeen, F. J. H., 12812, 13125
Freed, James M., 14071
Freeman, H. C., 12861, 12903, 12904, 13088
Freeman, Robert A., 13245
Freese, M., 12863
Freihofer, Warren C., 14082
French, Robert R., 12785, 13853
Fromm, Paul O., 13742, 13965
Frost, R. H., 13190
Frost, S., 13642
Froud, G. C., 13013
Fry, F. E. J., 13152
Fryer, J. L., 12806, 12839, 12840, 12844, 13289, 13382,
Fryer, J. N., 14205
Fujihara, M. P., 13869
Fulton, Leonard A., 13196
Fushimi, Shizue, 13905
Futch, Charles R., 13982

Galkina, L. A., 12887, 13032
Galkina, Z. I., 13525
Gard, Richard, 13796
Gardiner, George R., 13338
Gardner, D. R., 13451
Gardner, Linda J., 12945
Gardner, Michael L. G., 13154
Garlov, P. E., 12985
Garnett, D. G., 13438
Gasaway, Charles R., 13331
Gasimagomedov, A. A., 13746
Gay, Wallace C., 13969
Gaydash, Yu. K., 13145
Gee, J. H., 13102
Gee, John H., 14038
Gehringer, Jack W., 13494
Gentleman, Susan, 12820
Georgia Game and Fish Commission, Sport Fish. Div., 14181
Gerald, Jerry W., 13694
Geraskin, P. P., 12853
Gerday, Ch., 13044
Gerking, Shelby D., 14113
Ghittino, P., 13356, 13747, 13849, 13850, 13851
Gibson, James R., 13781
Gibson, Quentin H., 13452
Gilbert, John R., 13637
Gillen, Robert G., 13788
Gilpin, B. R., 13813
Ginzburg, Ya. I., 13672
Given, Robert R., 13691
Gloxhuber, Ch., 13192
Gnaedinger, R. H., 14111
Godfriaux, Bruce L., 13995
Goldberg, Edward K., 13420
Goldwater, Leonard J., 13518
Golovanenko, L. F., 13467, 13743
Gomes, F. V. Barreto, 14217
Gomez, Ricardo, 13286
Gooding, Reginald M., 14048
Gordeyev, N. A., 13684
Gordeyeva, L. N., 12912
Gordon, R. W., 13891
Gordy, Herbert R., 13293
Gots, Barra L., 13627
Gould, R. W., 12806
Gould, William R., 12939
Graff, Delano R., 12986
Graham, B. W., 13596
Graham, Charles R., Jr., 13782
Graham, Jeffrey B., 13727
Granmo, A., 14214
Grant, Blake F., 13342, 13687
Grant, George C., 13991, 13993

Gras, Jean, 13740
Gray, J. R., 13874
Gray, R. W., 12952, 13237
Graynoth, E., 13953
Green, James H., 13624
Greenough, Joseph W., 13985
Greer, G. L., 13451
Gregory, Richard W., 12791
Greig, R. A., 14111
Griffith, N. A., 13300
Grigoropoulos, Sotirios G., 13205
Grimaldi, E., 13947
Grinstead, Bobby Gene, 13291
Gritsenko, O. F., 13022
Grzenda, Alfred R., 13543
Gudefin, Y., 13740
Gulidov, M. V., 13048
Gulland, J. A., 14119
Gunderson, Don, 13282, 13622
Gunning, Gerald E., 12800
Gusev, G. P., 12954, 12981, 13023
Gustafson, K.-J., 13560, 13695, 13696
Gutenmann, W. A., 13767
Guthrie, J. E., 12886
Gutz, Manfred, 13820

Haas, Robert, 13515
Habener, Joel F., 14190
Hafeez, M. A., 12959, 13408
Haga, Hideo, 13218
Haga, Yoshiko, 13218
Hagino, Tokiko, 13218
Haider, Gerhard, 14201
Hale, John G., 12999
Hall, Shelby J., 13888
Halver, John E., 12850, 13153, 13453, 14218
Hamed, M. G. E., 13610
Hamelink, Jerry L., 13542
Hamer, Paul E., 14158
Hamilton, Andrew L., 13104, 13594
Hanek, George, 13111, 13202, 13411, 13766
Hanes, D., 13427
Hannan, Herbert H., 13299
Hansen, David J., 13179, 13798, 13841
Hansen, Hans J., 13780
Hansen, Martin J., 13565
Hansson, Kerstin, 13885
Harada, Katsuhiko, 13217
Haraguchi, Tatsuichi, 13230
Haram, O. J., 14104
Hardig, Jan, 13697
Harman, Paul D., 13036, 13128
Harris, J. E., 13412
Harrises, Antonio E., 12958
Hartman, Wilbur L., 13816
Hashimoto, Kanehisa, 13277
Hashimoto, Susumu, 13834, 13835, 13836
Hashimoto, Yoshiro, 12923, 13273
Hasler, Arthur D., 14148
Hass, H., 13433
Hastein, Tore, 14208
Hatfield, C. T., 13373
Hauser, B. W., 13583
Hauser, William J., 13000
Hayashida, Ted, 13415
Hayasi, Sigeiti, 13389
Haydock, Irwin, 13161, 13162
Hazel, Charles R., 13077, 13902
Heard, W. R., 13305
Heckman, J. Robert, 12993
Heckmann, Richard, 13511
Heidel, S. G., 13581
Heiser, David, 13640
Heitmuller, P. T., 14054
Heitz, Jean G., 13808
Hell, C. E. B., 13185
Hellawell, J. M., 13163, 13481
Helm, William T., 14155, 14202
Hem, J. D., 13581
Hemmings, C. C., 14110
Henry, Kenneth A., 13924
Hepher, B., 14010
Herman, Roger Lee, 12805, 13664
Herman, Sidney S., 14096
Herricks, Edwin E., 13692
Hettler, William F., Jr., 12919, 12995 13050, 13293, 14004
Heuschmann-Brunner, G., 13653
Hewett, C. J., 13814
Heyl, Henry L., 13403
Hibiya, Takashi, 13235, 13279, 13847
Hicks, Don, 13314
Hidaka, Iwao, 13753
Higgs, D. A., 13099, 14066
Hightower, Frank, Jr., 13215
Hildebrand, Stephen G., 13122
Hill, B. J., 12819, 12820
Hilsenhoff, William, 12980
Hiltibran, Robert C., 13791
Hiltz, Harold K., 13979
Hines, R., 13482, 13662, 13821
Hirano, Tetsuya, 13705
Hirata, Kenji, 13265
Hirata, Miyoshi, 13756
Hirayama, Kazutsugu, 13207
Hiroi, Osamu, 12888, 13647
Hislop, J. R. G., 14110
Hochachka, P. W., 13431, 13449, 13771
Hodder, V. M., 12951, 13872
Hodgins, Harold O., 12823, 12961, 13352 14213
Hodkinson, Madeline, 12807
Hoff, Frank H., Jr., 13772
Hoff, James G., 13700
Hoffert, J. Russell, 13742
Hoffman, C. E., 13579
Hoffman, Glenn L., 13508, 13663

Hogan, James W., 12947, 13881
Hogan, Roger L., 13880
Hogarth, W. T., 13750
Hoglund, Lars B., 13697
Hokanson, Kenneth E. F., 13169
Holeton, George F., 13240
Holland, D. C., 13605
Holland, H. Tom, 14047
Holland, Hugh T., 13385
Holmes, John C., 13793, 14037
Holmes, R. S., 12843
Holmgren, S. K., 13588
Holstein, B., 13775
Holway, Jamieson E., 13298
Honma, Shinji, 13210
Honma, Yoshiharu, 13210
Horne, D. A., 14028
Horowitz, J. J., 13517
Horton, H. F., 13935
Hoss, D. E., 14004
Houde, E. D., 13432, 13972, 13982
Houser, Alfred, 13978
Houston, Arthur H., 13928, 13929, 13941
Howard, A. E., 14172
Howard, H. C., 13002
Howard, T. E., 13013
Howell, John H., 12971
Howell, W. Mike, 13249, 13706
Howmiller, Richard P., 14152
Howse, H. D., 12885
Hoyle, R. J., 14028
Hoyt, Robert D., 12816, 14146
Huang, Ting-lang, 13918
Hudson, J. Harold, 13008
Huet, Marcel, 13469
Huggins, A. K., 13787
Hughes, G. M., 13446
Hughes, Janice S., 13070
Hughes, Robert A., 13400
Hungate, F. P., 13869
Huni, A., 13642
Hunn, Joseph B., 13034, 13130
Hunsaker, Don, II, 12789, 13006
Hunt, Evelyn P., 13109
Hunter, Alan, 12807
Hunter, J. G., 13491
Hunter, John R., 13317, 13804, 13805, 13809
Hunter, Robert C., 13965
Huntsman, Gene R., 12846, 13707
Hurlburt, E. M., 13344
Hutchinson, Brendan P., 13555
Hyde, Jackson, 13599
Hynes, H. B. N., 13116, 13117

Idler, D. R., 12861, 12883, 12903, 12904, 13088, 13856, 13859
Iida, Zenzo, 13757
Iimori, Masahide, 13230
Iles, Christine, 13115
Il'ina, L. K., 13025
Il'yenko, A. I., 14134
Imler, Richard, 13307
Ingles, C. J., 13114
Inland Fisheries Branch, Calif. Fish and Game, 13080
Inoue, Shin-ichi, 13756
International Council for the Exploration of the sea, 14049
International Pacific Salmon Fisheries Commission, 14144
Ipatov, V. V., 13531
Ishak, M. M., 13165
Ishida, Teruo, 13830, 13831, 13832
Ishii, Kiyoshi, 13645
Ishikawa, Yoshiro, 13830
Isoda, Sumiro, 13756
Issi, I. V., 13746
Itazawa, Yasuo, 13233, 13276
Ito, Jun, 13853
Ivanchenko, L. A., 12848
Ivanchenko, O. F., 12848
Ivanov, V. N., 14127
Ivanova, M. N., 13532
Iversen, E. S., 13187
Iwanaga, Noriyuki, 13204, 13266

Jackson, William B., 13200
Jacobi, G. Zolton, 13251
Jacobsen, Vøgg H., 13437
Jamsen, F. W., 13091
Jamsen, G. C., 13091
Jamsen, Gale C., 13711
Jancovic, M., 13442
Jangaard, P. M., 14059
Janicki, Ralph, 12953, 14062
Jarman, Ron, 13066
Jarzynowa, Barbara, 14001
Jatzke, P., 13718
Jaw, C. Y., 13945
Jearld, Ambrose, Jr., 14094
Jefferies, D. F., 13814
Jenkins, Robert E., 13992
Jenkins, T. M., Jr., 13351
Jensen, A. L., 13628, 14136
Jensen, Albert C., 13734
Jensen, Paul T., 13599
Jergil, Bengt, 13243
Jernelov, A., 13422
Jessop, B. M., 13828
Jewell, William J., 14223
Johnels, A. G., 13423
Johnson, A. Kenneth, 13060
Johnson, Allyn G., 12961, 14213
Johnson, B. Thomas, 13933
Johnson, Clarence L., 13453
Johnson, Donald W., 13705, 13843
Johnson, F. Allen, 13007
Johnson, G. Nelson, 12919

Johnson, James E., 12797, 13180
Johnson, Keith A., 13794
Johnson, W. E., 13582
Jones, Bernard R., 14039
Jones, J. W., 14104
Jones, John D., 13721
Jordan, Carol, 13395
Joseph, Edwin B., 13991, 13993
Joseph, M. M., 14081
Joy, James E., 13795
June, Fred C., 13983
Junge, Charles O., 13059

Kabata, Z., 13336
Kaesler, Roger L., 13288, 13852
Kakino, Jun, 13204, 13266
Kallman, Klaus D., 12899
Kal'nibolotskii, A. A., 13838
Kamiya, Mie, 13776
Kanao, Munefumi, 13756
Kanazawa, Akio, 13225
Kanid'yev, A. N., 13466
Kanna, Koichi, 13224
Kanwisher, John W., 13770
Kapoor, Inder P., 14008
Kariya, Teiji, 13218
Karzinkin, G. S., 13020
Kashiwada, Ken-ichi, 13225
Kashiwagi, Masaaki, 12847, 13611
Kasymov, A. G., 13915
Katayama, Teruhisa, 13265, 13270
Kato, Mamoru, 14197
Katz, E., 13823
Katz, M., 13909
Katz, Yair, 13774
Kawai, Akira, 13272
Keleher, J. J., 13829
Keller, Walter T., 13969
Kemp, P. H., 14016, 14060
Kennamer, Earl F., 13119, 13136
Kerr, S. R., 14029, 14030, 14031
Kershaw, W. E., 13642
Kerswill, C. J., 13619
Khalil, S. R., 13165
Khalilov, A, R., 13915
Khalturin, D. K., 13463
Khan, N. Y., 13861
Khashem, M. T., 13137
Khaskin, V. V., 13537
Khazov, Yu. K., 13669
Khokhar, R., 13703, 14090
Khoroshko, P. N., 13132
Kikawa, Shoji, 13387
Kilambi, R. V., 13579
Kiley, Charles W., 13118
Kilgen, Ronald H., 13960
Kim, Wan Soo, 13635
Kimball, Dan C., 14155
Kimura, Makoto, 13598, 13898
King, Everett L., 12971
King, Everett L., Jr., 13254
Kinney, Edward C., 13505
Kinter, William B., 14062
Kira, Keiko, 13211, 13269
Kirpichnikov, V. S., 13094
Kisker, Dale S., 13354
Kitamikado, Manabu, 13221
Kitamura, Sasaburo, 13223
Kiyashko, V. I., 14130
Klaassen, Harold E., 13546
Klawe, W. L., 12896
Kleeman, Karl T., 13289
Kleerekoper, H., 12957
Klein, David H., 13420
Klein, Richard G., 12850
Klima, Edward F., 13181
Klishevich, Alex W., 13593
Klontz, G. W., 13298
Knaggs, Eric H., 13899
Kobayashi, Tetsuo, 13833
Koch, R. B., 14220
Kocylowski, B., 13357
Koehn, Richard K., 13641
Kogan, A. V., 13530, 13683
Kokhanskaya, Ye. M., 13146
Kokhanskaya, Evgenia Mikhailovna, 13468
Kolb, Richard, 12990
Kolbye, Albert C., Jr., 13614
Komachkova, Z. K., 12984
Konar, S. K., 12879
Kondo, Kazunobu, 13071
Koo, Ted S. Y., 12871
Kopperdahl, Fredric R., 14156
Korn, Sidney, 12790
Kosaka, Sunao, 13832, 13986
Kostyunin, G. M., 13466
Kotlyarevskaya, N. V., 12834
Koto, Tsutomu, 13383, 13389
Kott, E., 14203
Kozik, M., 13608
Kozlov, V. I., 13670
Kozlov, Yu. P., 13535
Kramer, R. H., 13878
Krantz, George E., 12882, 14011
Krasil'nikova, S. V., 13917
Krcma, Richard F., 13495
Krivobok, M. N., 13139, 14123
Kroger, Richard I., 13707
Krogius, F. V., 13454
Krokhin, Ye. M., 13454
Krueger, H., 13427
Kruger, F., 14188
Krumin', V. M., 13684
Krygier, James T., 13011
Kubota, Minoru, 13758, 13759
Kudinskii, O. Yu., 12870
Kudrinskaya, O. I., 12908
Kudrinskaya, O. M., 14126
Kuehne, Robert A., 13248
Kuhns, William J., 13414
Kulikova, N. I., 13679

Kulikova, O. S., 13539
Kume, Susumu, 13389
Kunda, Michio, 13830
Kunnemann, H., 13029, 13030
Kurenkov, I. I., 13454
Kurland, Leonard T., 13614
Kutchai, Howard, 13741, 14089
Kuz'min, A. N., 13018
Kuz'mina, V. V., 13144, 13685
Kuznetsov, A., 13431
Kuznetsov, V. A., 14124
Kwain, Wen-hwa, 13942

Laarman, Percy W., 13558, 13570
LaBar, George W., 13176
Lachner, Ernest A., 12968, 13992
Lackey, R. T., 12833, 13736
Lagios, Michael D., 13415
Laine, Jorma J., 12813
Lambou, Victor W., 13457
Lander, Robert H., 13058, 14150
Lane, Charles E., 13106
Lang, K., 13440
Lantz, Kenneth E., 14189
Lanzing, W. J. R., 13255
Lapin, V. I., 13680
Larkin, P. A., 12905, 14032
LaRow, Edward J., 12859
Larson, Gary, 12994
Lasker, Reuben, 13809
Lattimer, John M., 12926
Lau, L. Stephen, 13501
Laudien, H., 13029, 13030
Laurs, R. Michael, 12935
Lavrova, E. A., 12981, 13023
Lawler, G. H., 13698
Lawrence, James L., 13417
Lawrie, A. H., 12799
Lawson, Kenneth D., 13770
Leatherland, J. F., 12900
Lederis, K., 13406
Lee, Dong-liang, 13919
Lee, G. Fred, 13400, 14167
Lee, P. J., 13473, 14027
Lee, R. L. G., 13828
Lee, Terrence H., 13170
Leet, W. S., 12896
Lefler, E., 13823
Legge, Thomas N., 13751
Legler, D. W., 13786
Lehmann, Johannes, 13819
Lenarz, William H., 13624
Lennon, Robert E., 12876, 13130
Leong, Roderick, 13806
Leont'yev, V. G., 14132
Leray, C., 13717
Lester, R. J. G., 13655
Levesque, Raymond C., 13306
Lew, Sam, 13843
Lewis, D. H., 14140
Lewis, J. K., 13449
Lewis, Robert M., 12919, 13548, 13709
Lewis, Steven A., 13292
Li, M. F., 13158, 13395
Li, Y. P., 13945
Liao, I-chiu, 13918, 13919
Liao, Paul B., 13470
Lichtenberg, James J., 14206
Lichtenheld, Richard W., 13293
Lie, Ulf, 13354
Lim, Mee-yoon, 13919
Lin, Mou-chun, 13918
Lin, Y. S., 13945
Lindahl, P. E., 13185, 14076
Lindsey, C. C., 13330
Lindsten, Jan, 13885
Lindstrom, T., 13560, 13695, 13696
Ling, Victor, 13243
Lingis, Jo, 12953
Lipper, R. I., 12989
Liscom, Kenneth L., 13554, 14150
Lisk, D. J., 13767
Lister, D. B., 13930
Liu, O. C., 13801
Liversage, Richard A., 14080
Livingston, R. B., 13580
Livingston, R. J., 14216
Lo, Ming-chuan, 13919
Loeb, Howard A., 13860
Loeffel, Robert E., 13057
Lom, Jiri, 12817, 14191
Long, Clifford W., 14137
Lopinot, A. C., 13065
Lorenzen, Carl J., 13042
Loskutova, G. F., 13765
Loukashkin, Anatole S., 12964
Lowe, J. I., 12894, 13798
Lu, Yeoung-jaung, 13918
Ludke, J. Larry, 13366, 13781
Luhning, Charles W., 13036, 13128
Luk'yanenko, V. I., 12853, 12982
Luly, P., 14103
Lund, William A., Jr., 12792
Lunz, G. Robert, 13360
Lupo di Prisco, C., 13405
Luquet, P., 13562
Lux, F. E., 13198, 13958

MacCallum, Wayne R., 13101
MacCrimmon, Hugh R., 13553, 13627, 13932,
MacDonald, J. Rod, 13817, 13822
Macek, Kenneth J., 12790
Mackay, N. J., 13634
MacKelvie, R. M., 13123
Mackie, G. L., 13514
MacLean, J. A., 14038
MacPhee, Craig, 14058
Madan Mohan Rao, G., 14209
Madden, Jane A., 13928, 13929

Madsen, Monte L., 13174
Maeda, Frances S., 13854
Maekawa, Koji, 13708, 13832
Magee, John K., 13640
Magnuson, John J., 13426, 13808
Magomedov, G. M., 13682
Mailyan, R. A., 13142
Maitland, Peter S., 13156
Major, Richard L., 13290
Makow, D., 12863
Malar, T., 12957
Malik, Z., 13823
Malone, Thomas C., 12855
Maltezos, George C., 12792
Malyarevskaya, A. Ya., 13763
Manea, Gheorghe, 13911
Manikiam, John S., 12895
Manion, Patrick J., 13906, 13877
Mann, H., 13442
Mann, R. H. K., 13789
Mann, Walter C., 13548
Manohar, S. V., 12944
Mantel'man, I. I., 13015
Marchelidon, Jacques, 14068
Margolis, L., 12902
Mark, Harry B., Jr., 13721
Marking, Leif L., 12969, 12970, 12971
Marmorino, Concetta, 14185
Marnell, Leo F., 12789, 13006
Marquette, Willman M., 14137
Marshall, N., 13940
Martens, D. W., 13891
Martin, Duncan W., 13244
Martin, James R., 13262
Martins, J. M., 14217
Massaro, Edward J., 13777
Masuda, Isao, 13223
Mataruyeva, I. A., 12907
Materazzi, G., 13405
Mathews, C. P., 13483
Mathews, Stephen B., 12931, 13639, 13926
Mathur, Dilip, 13551
Matsukawa, Hiroshi, 13830, 13831
Matsumiya, Hiroyuki, 13229
Matsumura, F., 13815
Matsuura, Fumio, 13277
Matyukhin, V. A., 13537
Mauch, Paul E., 12852
Maxfield, Galen H., 14150
Maxwell, Riney, 13966
May, Robert C., 13811
Mayer, F. L., Jr., 13378
McAlister, W. Bruce, 12785
McBride, J. R., 13863, 13865
McCann, James A., 13569
McCarraher, D. B., 12791
McCart, P., 13129, 13936
McCauley, R. W., 13095
McCombie, A. M., 13797
McConnell, Robert J., 14169
McCormick, J. Howard, 14039
McDonald, J. G., 12905
McDougal, H. D., 12956
McDowall, R. M., 13617
McErlean, Andrew J., 13167, 13379
McFadden, T. W., 13339
McKechnie, Robert J., 13323, 13896
McKenzie, J. A., 12952, 13785
McKenzie, Laura S., 13052
McKim, J. M., 13109, 13931
McKone, D., 13126
McLain, Douglas R., 13124
McLain, L. R., 13112, 13722
McLeese, D. W., 12868
McNeil, William J., 12815
McPhail, J. D., 13330
McRoy, C. Peter, 13100
Meakins, R. H., 12809
Medvedeva, E. I., 13917
Meehan, William R., 13513
Meekin, Thomas K., 13638, 13639, 13644
Meeks, R. L., 13263
Mehrle, Paul M., 12955, 13342, 13687, 13778
Meier, Albert H., 14081
Meincke, K. F., 13031
Meister, A. L., 13938
Meith, Stephen J., 13077, 13902
Meleshko, A. A., 13523
Mel'nichuk, G. L., 13455
Mel'nikova, M. N., 13135
Menshutkin, V. V., 12826, 13454
Mensinger, Gary, 12845
Merna, James W., 13725
Merrell, Theodore R., Jr., 13985
Merriman, Daniel, 13425
Merriner, John V., 13173, 13750
Merritt, Robert B., 13641
Meske, Ch., 13434, 14171
Metcalf, Robert L., 14008
Metcalf, T. G., 13801
Meysner, Ye. V., 13533
Mihursky, Joseph M., 13379
Mikheyev, P. V., 13533
Mikheyev, V. P., 13533
Miles, Harry M., 13693, 13928, 13929
Miller, Bruce S., 12835
Miller, E. T., 14057
Miller, Edward R., 12986, 13500
Miller, Lee W., 13074, 13323, 14084
Miller, Robert Rush, 13855, 13950, 14145, 14157
Mills, A. D., 12880
Mil'man, L. S., 12943
Milne, P. H., 12854
Minckley, Charles O., 13068
Minckley, W. L., 13547
Miroshnichenko, M. P., 12825

Mishima, Seikichi, 13648
Mitans, A. R., 13021
Mitchell, Charles I., 13317
Mitson, R. B., 13328
Miura, Shigetsugu, 13217
Mizelle, J. D., 12956
Mizuno, Masanori, 13204, 13266
Moav, Rom, 13825
Mochul'skaya, V. F., 13529
Modin, John C., 12921
Moffett, Lesley Jan, 13574
Moiseyeva, Ye. B., 13133
Møller, Dag, 12830
Molnar, Gy, 13435
Momot, Walter T., 12860
Monan, Gerald E., 13498
Monk, Bruce, 13193
Moore, Donald, 14198
Moore, William S., 13855
Moring, John R., 12801
Morita, Yasuo, 13389
Morley, R. B., 13340
Morton, Stephen D., 13170
Morton, William Markham, 12929
Moser, Austin C., 13638
Moser, Byron B., 13314
Mounib, M. S., 13085, 13089, 13113, 13393
Mount, Donald I., 12795
Moyle, Peter, 13321
Muir, Barry S., 12832
Mulcahy, Maire F., 12827, 13484
Muller, R., 13826
Mullison, W. R., 13368
Mundie, J. H., 14033
Munns, R. K., 13605
Munro, A. L. S., 12810, 13485
Murawski, Walter S., 14163
Murayama, Shigeo, 14184
Murphy, J. P., 12989
Murphy, Philip G., 13371, 13790
Muzykovskii, A. M., 13363

Nagahama, Yoshitaka, 12892, 13646
Nagasawa, Sumio, 13071, 13905
Nahhas, Fuad M., 13557
Nair, J. H., III, 13372
Nakagawa, Heisuke, 13386
Nakai, Toshio, 13649, 13650, 13651
Nakamura, M., 13258
Nakamura, Takashi, 13268
Nakatani, R. E., 13644
Nakazawa, Nobuhiko, 13760
Narver, David W., 13633
Nasedkina, E. A., 13916
Natochin, Yu. V., 12954, 13023
Natovich, Yu. V., 12981
Nazarenko, L. D., 13026
Neer, Robert M., 14190
Neifakh, A. A., 12906
Neiheisel, T. W., 13172
Nelson, Norton, 13614
Nelson, Wesley C., 13189
Netsch, Norval F., 13978
Neuhold, John M., 13194, 13378
Newsome, William H., 14020
Nichols, J. H., 13956
Nichy, F. E., 13198
Nicol, J. A. C., 14221
Nicola, Stephen J., 13075, 13315, 13325
Niedermeier, William, 13888
Nigrelli, Ross F., 13414, 13438
Nikolaev, A. S., 14007
Nikol'skaya, I. S., 12979
Nims, Linda, 12839, 13382
Nishida, Hideo, 13833
Nishikawa, Yasuo, 13387
Nishimoto, Robert N., 12935
Nishiyama, Tsuneo, 12889, 12891, 13755
Noble, J., 13579
Noble, Richard L., 13702, 13735
Noble, Robert W., 13452
Noguchi, Tamao, 12923
Norden, Carroll R., 13047
Nordeng, Hans, 14042
Northcote, T. G., 12942, 13561
Nose, Takeshi, 13273
Noven, Bengt, 13592
Novy, James R., 13725
Nowak, Wojciech, 14002
Numachi, Ken-ichi, 13754, 13848
Nunogawa, Jerry H., 13501
Nyberg, Dennis Wayne, 14095
Nyman, O. L., 13827

O'Connell, C. P., 13447
Ogata, Yasuko, 14174
Ogilvie, D. M., 14205
Ogino, Chinkichi, 13204, 13220, 13235, 13266, 13279, 13757, 13847
Oguri, Mikio, 13278
O'Halloran, M. J., 13859
O'Hara, James, 13654, 13873, 14017
Ohnuma, Akihiko, 13758, 13759
Oide, Momoko, 13046
Okada, Shun, 12891
Okaichi, Tomotoshi, 12923
O'Leary, Ann, 12827
Olifer, S. A., 13355
Olifirenko, L. N., 13017
Olsen, James C., 13636
Olson, David P., 13886
Olson, P. A., 13644
Omarov, M. O., 13147
Ong, Hong-siong, 13921
Onishi, Toshio, 14184
Oren, O. H., 14173
Orlowski, Stanley J., 14096
Orsi, James J., 14166
Osada, Yasuaki, 13760

Osako, Masanao, 13853
Oseid, Donavon M., 13499, 13506, 13973
Oshima, Yasuo, 13760
Osipova, V. B., 13536
Ostroumova, I. N., 13140, 13748
Ott, A. G., 13935
Otto, Robert G., 13618
Overstreet, Robin M., 13409, 13410, 14222
Owen, I. L., 13369
Owen, John B., 13003
Ozaki, Hisao, 13818

Page-Jones, R. M., 13509
Palmisano, John J., 14202
Pang, Peter K. T., 14078, 14079, 14083, 14193, 14194, 14195
Pannella, Giorgio, 14061
Pantelouris, E. M., 13607, 14215
Paranyushkina, L. P., 14130
Paris, Doris F., 13543
Parisot, Thomas J., 13367
Park, Donn L., 13496
Parker, Jack Clark, 14019
Parker, Richard O., Jr., 12802
Parker, W. D., 13302
Parker, Wayne L, 13319
Parkhurst, Lawrence J., 13452
Parrish, P. R., 13798
Parrish, Richard H., 13899
Parsons, John W., 14141
Parsons, L. S., 12951, 13872
Pasquale, Nick, 13284
Pasternak, Kazimierz, 13728
Patalas, Kazimierz, 13591
Paterson, C. G., 13616
Patil, K. C., 13815
Patrick, Burton, 13515
Patrick, Ruth, 12828, 13288
Patten, Benjamin G., 13197
Pavlovskaya, R. M., 13464
Payne, A. I., 14107
Payne, R. H., 14021
Pearcy, William G., 13078
Pearson, A. J. A., 14105
Pedersen, Roger A., 14192
Pella, J. J., 12896, 13632
Pepper, V. A., 13936
Perepelkin, V. N., 13837
Perez, Julio E., 13641
Perkins, Herbert C., 13191
Perkins, Richard J., 14013
Perlmutter, Alfred, 13118
Permitin, I. Ye., 13532
Perrier, C., 13740
Perrier, H., 13740
Peterle, T. J., 13263
Peters, Gabriele, 13182
Peters, Hans M., 13247
Peters, Nicolaus, 13182
Peterson, Gary L., 13779
Petersson, Ake, 14178
Petrenko, E. B., 13917
Pflieger, William L., 14186
Phinney, Duane E., 13281
Pic, P., 13717
Pickford, Grace E., 14193, 14194, 14195
Pikhu, E. Kh., 13540,
Pikhu, E. R., 13540
Pilcher, K. S., 12839, 12844, 13289, 13382
Pine, R. E., 12880
Pinus, G. N., 13676
Pister, Edwin P., 14145
Pitombeira, M. S., 14217
Pitt, T. K., 13345
Pivnicka, Karel, 13098
Plack, P. A., 13800
Plate, G., 13183
Poddubnyy, A. G., 13684
Podushko, M. V., 14129
Podushko, Yu. N., 13522
Polishchuk, V. V., 12916
Polisini, J. M., 13131
Polovkova, S. N., 13532
Pope, J., 13716, 14040
Popov, A. V., 12982
Popova, A. A., 14133
Post, George, 13312, 13799
Potter, I. C., 12819, 12820
Potts, John T., Jr., 14190
Potts, W. T., 13448
Povoledo, D., 13596
Powell, Charlie R., 13713
Powell, Edwin C., 13557
Powell, Tom G., 13512
Power, G., 12822, 13828
Powles, P. M., 13438
Precht, H., 13030
Prentice, E. F., 13666
Preston, A., 13033
Price, Brian W., 14080
Priegel, Gordon R., 12938, 13552, 14153
Prikhodko, T. I., 12826
Primbs, E. R. J., 13967
Pritchard, Austin W., 13809
Pritchard, D. J., 13800
Pritchard, Hayden N., 14096
Prosyanyi, V. S., 13917
Protasov, V. R., 13684
Prowse, G. A., 13962
Pugh, John R., 13498
Pulford, Earl F., 13056
Purdom, C. E., 14172
Purvis, H. A., 13877
Putina, Ye. P., 13467, 14121
Putz, Robert E., 13508
Pycha, Richard L., 13121
Pyle, A. Bruce, 14159

Qadri, S. U., 13377, 13514, 13861
Quast, Jay C., 13810
Quay, W. B., 13408
Querfeld, C. W., 14221
Quimby, M. C., 14006

Rabe, Fred W., 13014, 13450, 13665
Radakov, D. V., 13459
Radha, E., 14211
Raleigh, R. F., 13175
Raleigh, Robert F., 13495, 13496, 14012
Ramsay, Andrew J., 13972
Randall, D. J., 14093
Rao, K. S. P. Bhushana, 13044
Rauck, G., 13443
Raymond, L. P., 13447
Recco, Rose A., 13308
Reed, Barry L., 13370, 13375
Reed, Paul H., 13380
Reed, Roger J., 13568, 13569
Regier, Henry A., 13101, 14143
Regier, L. W., 13858
Rehwoldt, Robert, 13376
Reichenbach-Klinke, H.-H., 13439, 13441, 13948, 14024, 14114
Reichenbach-Klinke, K.-E., 13441
Reimers, Paul E., 13062
Reinert, Robert E., 13884
Reith, Jan F., 13190
Reshetnikov, Yu. S., 14130
Reynolds, James B., 13124, 13558
Reynolds, Julian D., 14116
Richards, Brent D., 13965
Richards, C. E., 13238, 13993
Richards, William J., 13252
Richardson, William M., 13319
Riche, L. G., 13373
Richey, Eugene P., 13283
Ricker, W. E., 13157, 13362, 13912
Riggs, Austen, 13788
Rio, Guido J., 13308, 13477
Risebrough, R. W., 13419
Ritchie, Douglas E., Jr., 13256
Rizvanov, R. A., 13524
Robbins, Timothy W., 13551
Roberson, Kenneth, 13635
Roberts, R. A., 13989
Roberts, Ronald J., 12810, 13485
Robins, C. Richard, 12968
Robins, G. L., 14034
Robinson, Mark, 13990
Rodgers, Charles R., 12790
Roelofs, Eugene W., 13880
Roessler, Martin, 13257
Rogers, Donald E., 13631
Rogers, Wilmer A., 12930, 12936, 12965, 12983, 13090, 13093, 14170
Romanenko, V. I., 12915
Ronald, A. P., 14212
Rossi, A., 13051
Roszokowski, Jacek, 13946
Rothschild, Brian J., 12838, 13160
Rothwell, B., 13053
Rottiers, Donald V., 12948
Rottschafer, J., 13721
Royer, L. M., 13125, 13970
Rozenfel'd, L. S., 13361
Rudakovskiy, L. G., 13684
Rudling, Lars, 13399
Ruggieri, George D., S. J., 13438
Rundberg, H., 13561
Russell, T. R., 13786,
Russell, Thomas R., 13687
Russell, Warren J., 13413
Ryckman, J. R., 13091
Ryder, R. A., 13287
Ryland, J. S., 13956, 13957
Ryman, Nils, 13604
Ryzhova, L. N., 13143, 13456, 14131

Sabodash, V. M., 13606, 13762
Saddler, James B., 13783, 14091
Sadov, Ivan Alexandrovich, 13468
Saether, Ole A., 12962
Saha, J. G., 13125
Said, M. M., 14210
Saito, A., 13858
Saito, Kunio, 13220
Saito, Takeshi, 13223
Saito, Tsuneyuki, 13214, 13216, 13219, 13228, 13649, 13650, 13651
Saitoh, Hirohumi, 13203
Sakagawa, Gary T., 13121
Sakaguchi, Morihiko, 13272
Sakamoto, Mitsuru, 13589
Salmin, S. A., 13466
Salo, E. O., 13909
Sams, Roy E., 12977
Sanders, Herman O., 13933, 14053
Sanders, J. E., 12806
Sangalang, G. B., 13856
Sangha, Gurcharan K., 14008
Sano, Tokuo, 13723, 13724
Sappington, C. W., 13665
Sarig, S., 13658
Sarot, Daniel A., 13118
Sato, Ryuhei, 12847, 13611
Saunders, C. Richard, 13933
Saunders, Lloyd, 12822, 13785
Saunders, R. L., 13446, 13865
Savel'yeva, E. A., 14121
Savitz, J., 13171, 13626
Savvaitova, K. A., 13462
Sawicki, Leon, 13729
Schaefer, Richard H., 13688
Schindler, D. W., 13584, 13585, 13586, 13587, 13588, 13592, 13874
Schluter, M., 14052
Schmitz, Eugene H., 13244

Schneider, D. E., 13431
Schneider, James C., 14160
Schnick, Rosalie A., 13130
Schoettger, Richard A., 12991, 12992
Schreibman, Martin P., 12899
Schrijver, C. A., 13190
Schroeder, Thomas R., 13799
Schultz, R. Jack, 13564, 13855, 13950, 13959
Schwanbom, E., 14076
Schwartz, Frank J., 13360, 13749
Schwarz, Abby, 14097
Scott, D., 13994
Scura, Edward D., 13106
Sederak, A. D., 12941
Seki, Humitake, 12867
Selleck, Robert E., 13907
Senkevich, N. K., 13679
Sera, Hiroshi, 13271
Seraichekas, H. R., 13801
Serchuk, Frederic M., 12997
Servizi, J. A., 13891
Sethi, Hari S., 13303
Shafi, Muhammed, 13156
Shakhmatova, E. I., 12981, 13023
Shanks, Valerie, 13428
Shapiro, Raymond E., 13614
Sharipov, K. O., 13686
Sharma, R. K., 13194
Sharp, Ira, 13600
Sharpe, F. Phillip, 13006
Shatton, Jennie B., 14218
Shatunovskii, M. I., 12974
Shatunovskiy, M. I., 14125
Shaw, D., 13397
Shaw, Evelyn, 13712, 13714, 13715
Shaw, T. L., 13807
Shcherbina, M. A., 13529
Shearer, W. M., 12810, 13485
Shehadeh, Ziad H., 12808, 13779
Shelton, Emma, 13888
Shentyakov, V. A., 13144
Shentyakova, L. F., 12910, 13144
Sherk, J. Albert, Jr., 12925
Sherman, Kenneth, 13191
Sherman, Richard A. W., 13712
Shibata, Takeshi, 13649, 13650, 13651
Shibko, Samuel I., 13614
Shilov, V. I., 13669
Shimizu, Hiroya, 13756
Shingu, Chiomi, 13389
Shinoda, Yoshio, 13217
Shipman, William H., 13195
Shipp, Robert L., 13262
Shippen, Herbert H., 13290
Shirai, Nobuko, 13776
Shirota, Akihiko, 13222
Shishkova, E. V., 14007
Sholkovitz, Edward R., 13436
Shterman, L. Ya., 13538
Shul'man, G. Ye., 13150
Shurben, D. G., 13397
Shuvatova, T. F., 13467
Shvets, L. N., 13917
Shvydkaya, N. A., 13916
Sigel, M. Michael, 13413
Silliman, Ralph P., 12920
Sills, Joe B., 14149
Simmons, Andre, 13084
Simmons, David C., 14051
Sims, Carl W., 13497
Sindermann, Carl J., 12851
Singer, Frederick R., 14190
Singh, S. B., 12975
Sinha, V. R. P., 14102
Sinyukova, V. I., 13134
Sizov, I. I., 14007
Sjolseth, D. E., 13909
Skauen, D. M., 13940
Skeesick, Delbert G., 13061
Skerfving, Staffan, 13885
Skinner, John E., 13329
Slatick, Emil, 14138
Slicher, Anna M., 14193, 14194, 14195
Slinn, D. J., 12857
Small, James W., Jr., 13248
Smirnov, S. A., 13043
Smirnova, L. I., 13690
Smirnova, N. F., 13144
Smit, H., 13738
Smith, Albert C., 13900, 14070
Smith, C. E., 13127
Smith, C. Lavett, 13713
Smith, Carolyn D., 13732
Smith, Gary E., 14156
Smith, H. D., 13876
Smith, John Warren, 13205
Smith, Jim R., 13498
Smith, Lloyd L., Jr., 13169, 13499, 13506, 13516, 13892, 13973
Smith, Lynwood S., 13783
Smith, M., 13114
Smith, M. W., 14085
Smith, Michael, 13416
Smith, R. J. F., 13110, 13261, 13350
Smith, R. R., 13963
Smith, Roderick M., 13353
Smith, Stanford H., 12798, 14063
Smith, W. G., 12966
Smitherman, R. Oneal, 13960
Snelson, Franklin F., Jr., 14073
Snodgrass, P. J., 13153
Snyder, George R., 13792, 14169
Sobolev, Yu. A., 13677
Soin, S. G., 13674
Sokolova, M. M., 12981, 13023
Soldwedel, Robert H., 14159
Sollitt, Charles K., 13283
Solly, S. R. B., 13428
Solodilov, L. N., 13684

Solon, J. M., 13372
Solovov, V. P., 13521, 13765
Solov'yev, L. G., 13534
Solyus, A. A., 14132
Somero, George N., 13771
Somkina, N. V., 13764
Sonneborn, David W., 13780
Sorenson, LeRoy, 13507
Southward, A. J., 12856
Spall, Richard D., 13040
Spence, J. A., 13116, 13117
Spoor, W. A., 13172
Sprague, J. B., 12868, 12875, 12972, 13012, 13120, 14015
Srivastava, Anil K., 14193, 14194, 14195
Srivastava, V. M., 14118
Stainton, M. P., 13596, 13857
Stalling, David L, 12790, 13778
St. Amant, James A., 13319, 13600, 13887
Stauffer, Thomas M., 13079, 13096 13565, 14043
Steen, Johan B., 13741
Stepanov, V. S., 13144
Stepanova, N. S., 12979
Stephenson, N. G., 13052
Steucke, Erwin W., Jr., 12991, 12992
Stevens, Donald E., 13074
Stevens, E. Don, 13152
Stevenson, Frederick, 12860
Stevenson, Merritt R., 12897
Stickel, William H., 13614
Stockner, John G., 13590, 13595
Stolbov, A. Ya., 13537
Storeton-West, T., 13328
Storozhuk, A. Ya., 14123
Strasburg, Donald W., 12914
Street, J. C., 13378
Stroud, Richard H., 14023
Stucky, Norman P., 13546, 13840
Suda, Akira, 13384, 13388
Sudds, Richard H., 13689
Sukhenko, G. Ye., 12916
Sullivan, Sue, 13072
Sumari, Olli, 12813, 12814
Summerfelt, Robert C., 12841, 12852, 13040, 13054, 13055, 13068
Summerville, Vernon C., 12987
Sunaga, Tetsuo, 14196
Sutterlin, A. M., 12940, 13865, 13875
Sutterlin, N., 12940, 13875
Suzuki, Tsuneyoshi, 13206
Svoboda, Frank J., III, 12860
Svobodova, Z., 13906
Swedmark, M., 14214
Swift, Michael C., 13076
Swingle, Wayne E., 13510
Sych, Roman, 12893
Sykes, James E., 12836
Syrett, Roll F., 14039
Sytina, L. A., 13527
Tagari, H., 14010
Taguchi, Takeshi, 13234
Tait, J. S., 13095
Takashi, Reiji, 13214, 13219, 13216, 13228
Takashima, Fumio, 13235, 13279, 13847
Tan, Y. T., 14199
Tanaka, Koji, 13818
Tanaka, Tamotsu, 13986
Tanaka, Tetsuhiko, 13830, 13831
Tarkovskaya, O. I., 13139
Tarr, H. L. A., 12865
Tarrant, Robert M., Jr., 13544
Tarusov, B. N., 13535
Tarzwell, C. M., 12878, 13575
Tatum, William R., 13903
Taub, Stephen H., 13073
Taylor, Angela E. R., 13826
Taylor, E. W., 14087, 14088
Taylor, William J., 13543
Teal, John M., 13770
Tedla, Shibru, 12824
Templeton, R. G., 14106
Templeton, W. L., 13731
Teodorovich, Vladislav Antonovich, 13468
Terhune, L. D. B., 13490
Tesch, F. W., 13607, 14215
Teshima, Shin-ichi, 13225
Theis, G. L., 13309
Thomas, Nelson A., 13358
Thomas, Robert E., 13002
Thompson, Jack E., 13614
Thompson, John R., 12928
Thomsen, Walter, 13902
Thorne, Richard E., 13188
Thorpe, Virginia A., 13609
Threlfall, William, 13111, 13202, 13411
Tibbo, S. N., 12866, 13087, 13802
Tidd, Wilbur M., 13418
Tilton, J. E., 12877
Timmermans, J. A., 13469
Timms, A. M., 12957
Timoshina, L. A., 13141
Tinsley, I., 13427
Todd, Ian St. P., 14032
Todd, John H., 13519
Tokunaga, Toshio, 13231
Tolchinskiy, G. I., 13534
Tomkiewicz, Linda A., 12924
Toney, Donald P., 13977
Topp, Robert W., 14162
Toyoda, Toshiko, 13223
Toyomizu, Masamichi, 13268
Traaten, B., 14124
Trams, Eberhard G., 14046
Tran, Daniel, 13657
Traxler, G. S., 13158
Trent, Lee, 14198
Trevithick, J. R., 13114
Truscott, B., 12883
Tsoi, R. M., 13035
Tsuchiya, Nobukuni, 13208

Tsunikova, Ye. P., 13528
Tsuyuki, H., 12829, 12937, 12942, 13337, 13343, 14212
Tucker, Thomas R., 13073
Tugarina, P. Ya., 13143, 13456, 14131
Turner, Charles H., 13691

Uchida, Naoyuki, 12890
Uchiyama, Hitoshi, 13208, 13229
Uda, Fumiaki, 13229
Uematsu, Kazuo, 13818
Ueyanagi, Shoji, 13387
Uki, Nagahisa, 13757
Umemoto, Shigeru, 13224
Umminger, Bruce L., 13166, 13643, 14092, 14115
Underdal, Bjarne, 14208
U. S. Dept. of Commerce, NOAA, NMFS, 13656
U. S. Dept. of Interior, Bur. of Comm. Fisheries, 12932, 13009, 13010, 13038
U. S. Dept. of Interior, Bur. Sport Fisheries and Wildlife, 12973, 13092, 13769, 13893
U. S. Dept. of Interior, Div. of Federal Aid Staff, 12842
Usami, Shuzo, 14182, 14183
Uthe, J. F., 13943
Utida, Seiitiro, 13776
Uto, Masami, 13387
Utter, Fred M., 12823, 12961, 13352, 14072, 14213
Uttormark, Paul D., 12980
Uyeno, Teruya, 14157

Vaas, K. F., 14005
Vallentyne, J. R., 13582
Vallet, F., 13717
Van Den Berg, Lowell A., 13614
Van Meter, N., 13187
van Overbeeke, A. P., 13863, 13865
Van Vliet, W. H., 13377
van Wyk, N. I., 13475
Vasil'chenko, O. N., 13019
Vaynshteyn, B. A., 12913
Veith, Gilman D., 13400, 14167
Vel'tishcheva, I. F., 13020
Verigin, B. V., 13460
Verma, Mahendra N., 13001
Vestergard Jørgensen, P. E., 14035
Vestnik Akademii Nauk SSSR, 14055
Vezina, R., 14101
Vickery, Robert L., 12958
Vielkind, J., 13704
Vielkind, Ursula, 13704
Vijverberg, J., 13738
Vilquin, A., 14041
Vinberg, G. G., 12811
Vincent, Richard, 13975
Vladimirov, V. I., 12911
Vladimirova, K. S., 12909
Vlasenko, A. K., 13132
Vogele, L. E., 13305, 13978
Volkova, L. A., 13024
von Grotthus, Erdmuthe, 13704
Von Vaupel-Klein, J. C., 13738
von Westernhagen, H., 13720
Voss, Edward W., Jr., 13413
Vrochinskiĭ, K. K., 13914
Vukovic, T., 13675

Wadley, Gerald W., 13545
Waggoner, John P., III, 13901
Wagner, Charles C., 14011
Wahlquist, Harold, 14180
Wahtola, C. H., Jr., 13003
Wakabayashi, Hisatsugu, 13211, 13269
Walden, C. C., 13013
Waldichuk, Michael, 12898
Walker, C. E., 13930
Walker, Charles R., 12971
Walker, M. Greer, 13328, 14219
Walkey, M., 12809
Wallace, Dale C., 14098
Wallace, Oliver P., Sr., 13886
Walsh, G. E., 14054
Walters, Carl J., 13572
Waluga, Danuta, 14003
Ward, Eileen, 13487
Warner, Kendall, 13870
Warner, Mark C., 12841
Washington, Percy M., 13320
Watanabe, T., 14174,
Watanabe, Taisuke, 14179
Watanabe, Takeshi, 13204, 13235, 13266 13279, 13757, 13847
Waterman, Talbot H., 13027
Watson, D. G., 13613, 13731
Watters, Kenneth, 12831
Waybrant, Ronald C., 13542
Weatherley, A. H., 12818
Weber, Don T., 13512
Wedemeyer, Gary, 13879
Weed Research Organization, 14056
Weinheimer, P. F., 13786, 13888
Weinhouse, Sidney, 14218
Weissler, Alfred, 13614
Welander, Arthur D., 13545
Wellborn, Thomas L., Jr., 13297
Wells, LaRue, 13430
Wells, Marion R., 13803
Wells, Ralph A., 12815
Wendler, Henry O., 12931
Westermark, T., 13423
Western, J. R. H., 13486
Westlake, G. F., 12957
Westman, Kai, 12813, 12814, 13151
Westrheim, S. J., 13097, 13343
Wheat, T. E., 14050, 14057, 14207
Whipple, William, Jr., 14176

White, Bruce D., 13969
White, E. G., 13623
White, George E., 13971
White, R. I., 13304
Whitford, W. G., 13603
Whitley, James R., 13424
Whitt, Gregory S., 12837, 12843, 12849, 12874, 12901, 12927, 13517, 13812, 13854, 13955, 14050, 14057, 14207
Wickham, Donald A., 13181, 13215, 13839, 14044
Wicklund, Robert I., 12881
Wigle, Donald T., 13028
Wile, Ivanka, 13797
Wiley, Martin L., 13492
Wilkens, E. Peter H., 12919, 13709
Willford, Wayne A., 12970, 13037
Williams, F., 13259, 14026
Williams, James D., 13249, 13910
Williams, Madelaine M., 13714
Williams, Robert T., 14065
Williscroft, S. N., 12829, 12942
Wilson, A. J., Jr., 12894, 13798, 13841
Wilson, Allan C., 13453
Wilson, Nadine, 13416
Wilson, P. D., 13798
Wilson, R. S., 13488
Wilz, Kenneth J., 12934
Windsor, D. C., 13829
Wingfield, W. H., 12844, 13382
Winter, Donald R., 13246
Winters, G. H., 13341
Wirth, Thomas L., 12980, 13552
Wise, Robert H., 14065
Wissing, Thomas E., 14148
Wissmar, Robert C., 13014
Withler, F. C., 13340
Witt, Arthur, Jr., 13424
Wohlfarth, G., 13825
Wohlschlag, Donald E., 14200
Wolf, Ken, 14006
Wollam, Michael B., 13981
Wood, Chris M., 14093
Woodey, James C., 13188
Woodhead, P. M. J., 13348
Woods, Carlene E., 14099
Woods, R. John, 13928, 13929
Wrenn, William B., 14164
Wright, Kenneth J., 13844
Wright, Sam, 12990
Wright, Samuel G., 13280, 13285
Wu, Wilson Sheng-yu, 13922
Wyatt, Ellis J., 13005, 13883

Yacovino, Joseph T., 13264
Yakovleva, I. V., 12984
Yakubov, S. M., 13535
Yamada, Juro, 13708
Yamada, K., 13258
Yamada, Kinjiro, 13217
Yamaguchi, Katsumi, 13277
Yamamoto, Hiroshi, 13221
Yamamoto, Kiichiro, 12888, 12892, 13645, 13646
Yamashita, Hideo, 13226, 13227
Yamazaki, Fumio, 12864, 13396
Yap, H. H., 14220
Yarbrough, James D., 13803
Yashouv, A., 13482, 13659, 13662, 13821, 13824
Yevich, Paul P., 13338
Yoder, Warren G., 14077
Yokote, M., 13258
Yokote, Motoyoshi, 13845, 13846
Yokoyama, Henry, 13265, 13270
Yong, Marian Y. Y., 12838
Yoshida, Yoichi, 13212, 13213, 13271, 13274, 13275, 13752
Young, Reginald H. F., 13501
Youssef, Y. A., 13165
Yu, Man-Lim, 13118
Yu, Shaw L., 13952, 14176
Yuen, Heeny S. H., 12950
Yurovitskii, Yu. G., 12943

Zabolotskiy, A. A., 12912
Zalumi, S. G., 13520
Zamojska, Barbara, 13999
Zaugg, W. S., 12796, 13112, 13722
Zaytsev, K. N., 13144
Zelazny, J., 13357
Zheltov, Yu. A., 13917
Ziebell, C. D., 12880
Zitko, V., 13390, 13802
Zuyev, G. V., 13681
Zweifel, James R., 13804

*****

SUBJECT INDEX FOR VOLUME 16

Age and growth,
age,
composition,
of sardine landings on Pacific Coast, 1965-66, 13898
revised-, of Pacific mackerel catch off Southern Calif., 1958-64, 13899
determination of fishes, 13958
anchovy, northern, larvae, effect of food density, 13447
annulus formation on scales of Uchinsk Reservoir roach, 13675
assessment, tissue selection for RNA-DNA ratio technique, 13889
bass,
largemouth, first year-class in new Fla. impoundment, 14047
smallmouth, effects of fin-clipping, 14139
striped, comparison of scales, otoliths and opercula, 14166
white, in Lake Winnebago, Wisconsin, 14153
biostimulators: lysine and terramycin, re growth and condition of market fish, 13361
bream, European, age-related changes of Cu and Zn, Kuibyshev Reservoir, 13026
carp,
effects of spawning time variation on subsequent growth and viability of young, 13825
in altered environment, Kansas, 13546
in dilute copper sulfate solutions, 13818
Lake Carl Blackwell, Oklahoma, 12852
spawners in Kuibyshev Reservoir, USSR, 13536
carpsucker, in altered environment, Kansas, 13546
catfish, channel, influence of temperature and photoperiod, 13579
centrarchids, scale and body growth, 2 Oklahoma farm ponds, 13064
circulus formation on scales of young sockeye re feeding level, 14034
cisco larvae, temperature requirements for, 14039
Coregonus peled, acclimatized in northeastern Poland, 13729
crappie, black, juvenile, re scale development, 14154
drum, freshwater, eye lens as indicator, 13200
eel,
American, in Newfoundland waters, 13237
European, growth in freshwater culture ponds re sex, 13842
fishes, Woods Hole, Mass. area, number and lengths by season, 13198
food,
conversion, effects of temperature on coefficients β', β, and γ, Seriola, gadus, 13275
uptake and conversion efficiency, Seriola, 13274
goldfish, in dilute copper sulfate solutions, 13818
grayling, age-related changes in blood, Lake Baikal, 13143
growth,
-control technique, cultured trout, 13310
efficiency of fish,
in nature, prediction of, 14030
laboratory analysis, 14029
menhaden, food habits of young re metamorphosis, 13983
minnow, silverjaw, 14098
nomogram compilation re growth from scales, 12910
otoliths, daily growth layers and periodical patterns, 14061
perch, European, in two Scottish lochs, 13156
percid larvae, effect of food and temperature, 14126
plaice,
fed proteins from plants and other sources, 14040
larvae, observations on development in aquaria, 13957
O-group-, on diets containing different protein levels, 13716
prolarvae, effect of temperature on growth efficiency, 13956

Age and growth, cont.
reconstruction of growth using white bream, Lake Il'men', USSR, 13149
RNA-DNA ratios as indicators of recent growth rates of a fish, 13349
salmon,
Atlantic,
growth rate between Greenland and home waters, 13445
young in White Sea rivers, 13135
chinook, fingerlings, temperature effects, 13295
chum, re histology of branchial epithelium, osmoregulation, 12847
coho, pre-smolt, effect of salinity, 13618
embryos, temperature and Xrays re mortality and growth, 13545
kokanee, Lake Tahoe, 13325
landlocked, effects of jaw-tagging on growth and scales, 13870
pink, embryos and fry, re spawning bed quality, 12815
sockeye,
alternation of age of return in Skeena River, a hypothesis, 13867
in Lake Aleknagik, Alaska, 1962, 13632
otoliths for age determination, 13635
salmonids,
female-, re egg size, 13525
in small mountain lake, Sweden, 13560
sardine, Pacific, age composition of 1964-65 landings, 13598
sculpin, shorthorn, in Newfoundland waters, 13335
sea-trout, from River Vistula, 11-year study, 12893
shad, threadfin, central Arizona reservoirs, 12797
sole, lined, development of laboratory and bay specimens, 13982
sturgeon,
duration of early postembryonal stages, 13527
Volga, age and size re egg weight and composition, 14123
Tilapia mossambica, experimental populations, 12920
trout,
and char marked with nylon thread tag, Sweden, 13695
brook, effects of long-term exposure to copper, 13931
brown, in northern Scottish lochs re fisheries improvement, 13164
cutthroat, 14058
in Chef Creek, British Columbia, Canada, 12949
sea-run-, at Eva Lake, Alaska, 13550
lake,
age re residues of mercury and methylmercuric salts in, 13767
in Lake Superior before 1950, 13121
simulation model of, 14031
rainbow,
hatchery-, after exposure to DC electricity, 14150
re nitrogen and fat metabolism, 12960
stocked in Great Lakes, 13565
steelhead, in ninth year - taken at sea, 13320
tunas and marlins in Atlantic Ocean, 13389
walleye in,
Canton Reservoir, Oklahoma, 13292
Hoover Reservoir, Ohio, 13073
whitefish, Amur, scale growth and repeat spawning, 14129

Anatomy,
adenohypophysis, fine structure, chum salmon, 12892
adrenalcortical cells of hatchery and wild landlocked salmon, histological comparisons, 13866
bladder,
gas, ion fluxes across, in normal and diamox-treated brook trout, 13782
urinary, effect of urophysial substance on, rainbow trout, 13406
body size composition of Jap. mackerel re sexual maturity, 14182

Anatomy, cont.
brain,
-amino acids, young Atlantic salmon, 14068
dynamics of MS-222 during anesthia in freshwater fishes, 13034
peptides of fishes, 13764
rainbow trout, effect of MS-222 on water- and electrolyte content, 13037
teleost, developmental genetics of LDH isozymes, 12874
temperature-sensitive neurons, brook trout, 13451
branchial epithelium of chum salmon, histology in early growth re osmoregulation 12847
bream, European, biology of early stages under deepwater conditions, 14128
caeca, pyloric, properties of proteolytic enzymes, chum salmon, 12890
cobia, prejuvenile and juvenile, Gulf of Mexico, 13250
condition and,
fatness of blue bream in Rybinsk Reservoir, 13137
growth of carp and carpsucker in altered environment, Kansas, 13546
corpuscle of Stannius,
changes during migration,
Atlantic salmon, 13403
chum salmon, 13647
re serum electrolyte regulation in mummichog, 14078
development of laboratory and bay specimens of lined sole, 13982
eggs and larvae of mullets of Israeli coast, 13824
endocrine glands and osmoregulation of teleosts, 13278
epidermis, histochemistry of mucous of eel, 13209
eye,
lens as age indicator in freshwater drum, 13200
of weakfishes, reflecting spheres in, 14221
teleost-, developmental genetics of LDH isozymes, 12874
feeding, mechanics of, in various teleosts, 13374
fin degeneration in young alewives of Lake Michigan, 13047
gill,
ATPase activities of coho, alteration by ouabain injection and salt-water adaptation, 13722
filaments, histologic structure in adult carp, 13539
hyperplasia, systematic grading of, 13312
rakers and food selectivity in mackerels, tunas, dolphins, 13808
water flow and gas exchange, rainbow trout, 13241
glands,
hatching-, functioning in loach re oxygen, 11834
ultimobranchial-, and calcitonin in fishes, 14083
gonadal biopsy, evaluation from tag returns, striped bass, 13256
internal development of young tunas, 13252
intestine,
carp, vitamin B_{12} production by microbes, 13225
eel, alkaline phosphatase from intestinal mucosa, 13046
goldfish, Na+/K+-ATP activity and Na transport in, changes re temperature, 14085
thiamine and thiaminase activity in, effect of food, silver carp, 13763
kidney,
effects of hormones on, in gonadectomized sockeye, 13864
hemosiderin re erythropoiesis in blue gourami, 13118
in cation homeostasis in anadromous and other fishes, Lake Dal'neye, 13023
relationship between Na resorption and Mg secretion, salmon, 12981
teleost-, coupling of Mg secretion and Na reabsorption, 12954
lamprey, southern, brook, 13706
length-weight relationship, condition,
grayling in Alaska, 13569
red drum in southeastern Louisiana, 13549
lens protein polymorphisms in hatchery and natural trout, 14147

Anatomy, cont.
leucocytes, fish-blood-, chromosome preparation from, 12993
liver,
activity of energy-metabolizing enzymes, kokanee salmon, 13649
cells, sexual differences in goldfish, 13645
composition of mature lampreys, 14203
effects of hormones on, in gonadectomized sockeye, 13864
extraction of nucleic acids with phenol, 13208
hemosiderin re erythropoiesis in blue gourami, 13118
protein-deficiency urocanase,carp, 13272
rainbow trout, glucose (hexose-6-phosphate) dehydrogenase content in, 14218
salmon, de novo biosynthesis of inosinic and uridylic acids, 12865
teleost-, mechanism of ammonia production from aspartate, 12953
thiamine and thiaminase activity in, effect of food, silver carp, 13763
translocation and yolk absorption in chum salmon development, 13833
mackerel larvae and juveniles in western North Atlantic, 13981
meristic differences,
Arctic char of Sagavanirktok Drainage, Alaska, 13129
between spring- and autumn-spawning Atlantic herring, 13872
metamorphosis of,
landlocked sea lamprey, 13096
young menhaden re food habits, 13983
morpho-biological characteristics of the eastern bream, 13668
morphological variation and recognition of subspecies in burbot, 13098
morphology,
alimentary tract in flatfishes re feeding and food, 13998
and variability of Arctic char, Kanchatka River, USSR, 13462
brook lamprey, 5 abnormally large specimens in Great Lakes, 13877
Japanese mackerel in early life stages re population fluctuation, 14179
juvenile chum and pink salmon, 12891
lake trout alevins, Lake Heney, Quebec, 13377
mouth size of fish larvae, studies, 13222
mullet, striped, unusual, from Florida west coast, 14162
muscle,
activity of energy-metabolizing enzymes, kokanee salmon, 13649
amino acids,
changes due to starvation, 13141
young Atlantic salmon, 14068
carp,
ATP-sensitivity of actomyosin and myosin, 13219
preparation of,
actomyosin from, 13216
myosin from, 13214
superprecipitation of actomyosin, 13228
composition of mature lampreys, 14203
extraction of nucleic acids with phenol, 13208
fish-,
determination of nucleotides, 13229
TMAO, TMA and DMA contents, 13231
glycolytic enzymes of, changes in activity in spawning kokanee salmon, 13650
protein extracts from elution patterns, Japanese fishes, 13224
skeletal-, of gadids, effect of starvation in exercise on, 14219
white,
post-mortem biochemical changes in sucker, pike, 12944
protein maps and amino acid residues, teleosts, 13045
myomeres,
effect of temperature on number in grunion, 13049
in herring larvae, determination of number, 12887
nerves, trypsin modification of Sihler staining technique for systematic studies, 14082

Anatomy, cont.
neurohypophysis,
of acipenserids in water of varying salinity, 12984
ultrastructural organization in sturgeons, 12985
opercula, comparison with scales and otoliths for striped bass aging, 14166
otolith,
comparison with scales and opercula for striped bass aging, 14166
daily growth layers and periodical patterns, 14061
for age determination in sockeye, 13635
ovarian tissue, cod, metabolism of pyruvate, 13089
ovaries,
of sockeye salmon, caloric values at last stage of marine life, 13755
post- and pre-spawned-, steroidogenesis in, tilapia, 13774
pancreas,
effects of hormones on, in gonadectomized sockeye, 13864
of river lamprey contains "insulin-like" factor, 13053
ultrastructure of islets in carp with diabetes, 13258
pineal organ,
demonstration and function of melatonin in chinook, 13404
teleost-, 5-hydroxytryptamine in, 13408
pituitary, 13133
changes of prolactin cells during life cycle, chum salmon, 13646
effects of hormones on, in gonadectomized sockeye, 13863
salmon- and eel-, prolactin study in, by immunofluorescence, 14224
seasonal variations in protein content, 13570
study in sturgeon and paddlefish, re growth hormone, 13415
pugheadedness in vermilion snapper, Gulf of Mexico, 13573
retinae of teleosts, organization of cone cells, 13392
reversal and blind-side pigmentation in North Carolina flounders, 13709
sailfish, Atlantic, developmental changes in young, 13494
salmonids and other fishes in 4 streams of southern England, 13789
scale,
and body growth of centrarchids in 2 Okla. farm ponds, 14064
characteristics, effects of jawtagging on, landlocked salmon, 13870
comparison with otoliths and opercula for striped bass aging, 14166
counts, lateral-line-, variation in Arctic grayling, 13936
development,
in juvenile Atlantic croaker, 13730
re growth of juvenile black crappie, 14154
feeding level re circulus formation in young sockeye, 14034
growing-, of rainbow trout, histochemical and structural aspects, 13708
growth and repeat spawning of Amur whitefish, 14129
irregular growth of, in European perch fingerlings, 13025
microfilm reader for analysis, 12990
roach of Uchinsk Reservoir, USSR, annulus formation, 13675
sensory organs of lateral-line system, development in ruff, 13043
sexing adult largemouth bass, externally, 13302
sexual dimorphism in painted greenling, California, 13601
skin,
effects of hormones on, in gonadectomized sockeye, 13864
surface-active agents for removal, 13230
sperm, rainbow trout-, peled-, effect of nitrosomethyl urea and dimethyl sulfate, 13035
spines, pectoral, decalcification technique for sectioning, 13003
spleen, hemosiderin re erythropoiesis in blue gourami, 13118
stomach,
effects of hormones on, in gonadectomized sockeye, 13864
method of estimating capacity, 14155

Anatomy, cont.
swimbladder,
development and function in haddock, 14097
lactate secretion in, role of carbonic anhydrase, 14089
permeability of, in eel, 13741
variability in carp from Kursk and Niva fish farms, 14133
testis,
changes during migration of masu salmon, 12888
fish-, metabolism of pyruvate and especially nitrophenols, 13085
guppy, sterilization by parathion, 13402
histological change of, in precocious masu salmon parr, 13987
hydroxysteroid dehydrogenases, mummichog, 13407
protamines and synthesis during development, trout, 13243
salmon, de novo biosynthesis of inosinic and uridylic acids, 12865
sockeye salmon, re 5'-nucleotidase, 12945
steroidogenesis in, northern pike, 13405
weights in tilapia before and after spawning, 13247
thymus of salmonids, lymphosarcoma of, 13664
thyroid gland, effects of hormones on, in gonadectomized sockeye, 13863
tubercles,
breeding-, and contact organs in fishes, 13492
nuptial, on female quillback, 13174
vertebral fragments for reconstruction of prey-fish size, 13540
weight, live- and dressed-, for commercial fishes of 4 Okla. reservoirs, 12845

Bacteriology,
Aeromonas,
hydrophila, incidence in yellow perch, Quebec, 14101
increase in bodies of dead fish, 13653
liquefaciens,
drug resistance factors, detection of, 14174
immunofluorescent detection in fish in lunar-exposure studies, 14140
punctata, in grass carp, chloramphenicol for control, 13922
re carp swimbladder inflammation, 13357
bacteria, production in freshwater reservoirs, USSR, 12915
Ceratomyxa shasta, eradication from water by UV and chlorine, 13301
Chondrococcus columnaris,
characteristics and pathogenicity re pond-cultured eel, 13211
influence of Columbia River fish ladders on, 13869
re gill disease in pond-cultured eels, 13269
flora of stream-incubated Pacific salmon eggs, 13086
Lactobacillus leichmannii, re vitamin B_{12} production in carp intestine, 13225
microflora of anchovy gut, conversion of DDT to DDD, 12855
microorganisms, marine, associated with food of young salmon, 12867
pseudomonad,
from rainbow trout lesions, proteinase properties, 13395
proteolytic-, morphology, from skin lesions of trout, 13158
Pseudomonas, re carp swimbladder inflammation, 13357
Vibrio anguillarum, re,
red disease of eel in German Bight, 13184
vibriosis in Pacific salmon cultured in Canada, 13868

Behavior,
activity,
effect on oxygen consumption of rainbow trout, 14209
of white sucker, influence of periods of light and dark, 13566
response to oxygen in brook trout, 12821
aggregation of Japanese mackerel, re environmental conditions, 14183
aggression and nest-building of stickleback re food, 13350
ammocoetes at low oxygen tensions, 12820

Behavior, cont.
avoidance reactions,
by salmonids to pollutants, 12972
of fish, 13376
breeding-, of Florida flagfish, effects of ABS on, 14045
chemical languages of fishes, bullhead experiments, 13519
defense of egg mass by painted greenling, 13601
feeding-,
mechanics of, in various teleosts, 13374
newly-stocked rainbow trout, re invertebrates in stream drift, 13351
northern anchovy, 12964
of flatfishes, re food and morphology of alimentary tract, 13998
fish-, effects of pollutants on, 13576
frightening of fish by explosion, 13684
Gasterosteus, effect of Schistocephalus plerocercoids, 13655
locomotor-, analysis in goldfish, 12957
migration of salmonid fry from natal gravels to rearing areas, innate control, 14012
noises of Pacific Ocean salmon, 14007
optomotor response of forebrainless tilapia, 13712
orientation of anadromous fishes, importance of pheromones, 14042
pike, northern, fry, as related to pond-culture, 13002
plankton-eating fishes, re feeding and starvation under different lighting, Lake Baikal, 13024
prespawning-, of sunfishes, environmental factors, 13261
prey capture in largemouth bass, 14095
pumpkinseed in Cranberry Pond, Mass., 13568
reactions of young salmonids to sudden pH, CO_2 and D.O. changes, 13697
reproductive-, shorthorn sculpin in Newfoundland waters, 12946
salmon,
chinook, effect of Hanford nuclear complex, 12978
fry, troughs and redds for study, 13062
masu,
dispersal and remaining of juveniles stocked in Mena River and Sannosukezawa-kawa River, 13830, 13831
schooling,
duration among separated and non-separated fish, 13715
fish-, methodological principles for study, 13459
modifiability re early experience, silverside, 13714
of fish, exemplified by horsemackerel, 13681
pelagic fishes in new Volta Lake, Ghana, Africa, 14116
sound production in courtship of 6 sunfishes, 13694
sounds, fish-, seasonal and diurnal occurrences in a small Fla. bay, 13479
spawning,
habits and fecundity of Arctic grayling, 13294
of chestnut lamprey, 13107
swimming-,
chum salmon off Kamchatka, 13206
effect of thyroxine on, cod, 13348
tuna, skipjack, through ultrasonic tracking, 12950

Benthos,
algae,
increase in milkfish ponds by application of silicate, 13920
procedure for primary production study, 12909
Alloperla nymphs, predation on salmon eggs, fry, 12788
aquatic insects, effect of low pH on survival and emergence, 14014
Boomer Lake, Oklahoma,
macroinvertebrates, 13039
re power-plant heated water, 13063

Benthos, cont.
burrowing, tool for collecting, 13437
Chaoborus,
larvae, vertical migration re oxygen tension, 12859
Nearctic and Palearctic, 12962
crustaceans as fish food, Dniepr Reservoir, USSR, 13761
differences above and below impoundment, 13116
distribution re artificial destratification, El Capitan Reservoir, 13080
effects of,
coho spawning on, Platte River, Michigan, 13122
gravel cleaning in 3 Alaskan streams, 13513
waste discharges on, simple method of assessment, 13904
Hexagenia naiads in Oklahoma reservoir, 13067
Lake Superior, re water quality and trophic condition, 13246
Lepidurus arcticus as brown trout food in Norwegian mountain reservoirs, 13699
macroinvertebrates,
basket-type artificial substrate for sampling, 14151
non-insect-, of upper Potomac River, cluster analysis, 13852
mayflies, food habits and ecology, St. Maries River, Idaho, 13813
microflora, ^{14}C-labelled-, liquid scintillation method for assaying, 13940
mysids, stocked in Mingechaur Reservoir, USSR, as fish food, 13915
periphyton, experimental lakes area, Canada, 13590
profundal, multiple corer for sampling, 13104
sampler,
quantitative-, artificial-substrate-, 13251
sled-mounted-, suction-, 13008
sampling,
comparison of effectiveness of Ekman- and Ponar grab, 14152
in shallow streams, plus substrate down to 50μ size, 14033
shallow-water-, simple corer vs. Ekman grab for sampling, 13616
stream,
communities, 12828
effect of industrial spills, 13692
evaluation of kicking technique for sampling, 13642
supply for fishes, re flow and pollution in Dniepr Reservoir, USSR, 13145
Washington Coast, species composition and structure of infauna communities, 13354
zoo-,
evaluation of separation by flotation, 12996
experimental lakes area, Canada, 13594

Bibliography,
Bureau of Sport Fisheries and Wildlife publications, Sept. - Oct., 1970, 13092
directory of fish culture research institutions, 13927
fish,
of the Gulf of St. Lawrence, 14118
parasitology, book, 13826
radioecology, estuarine, 12926
reclamation of waters, FAO review, 13130
Sacramento River Chinook Salmon Disease, 13367
sediments, suspended and deposited, re organisms, 12925
"Sport Fishing USA", published by USDI, Bur. of Sport Fisheries & Wildlife, 13769
Stizostedion species of North America, 13287
tuna, blackfin, 14051

Biocides,
algicides, copper sulfate, survival and growth of carp and goldfish in dilute solutions, 13818
fungicides,
mercury in the environment, 13518
phenylmercuric hydroxide, effects of short exposure of roach, 13185

Biocides, cont.
herbicides,
amitrole, toxicity to bluegill, 13070
aquathol, toxicity to striped bass fingerlings, 13297
aquatic-, boom applicator for, 13512
casoron, toxicity to striped bass fingerlings, 13297
CIPC, toxicity to bluegill, 13070
copper sulfate as algicide and fish medication, 13195
dalapon, toxicity to bluegill, 13070
dichlobenil,
effects on pond factors, 14054
toxicity to bluegill, 13070
diphenamid, toxicity to bluegill, 13070
diquat, toxicity to bluegill, 13070
effects on water and inhabitants, 13368
emid, toxicity to bluegill, 13070
endothal, toxicity to bluegill, 13070
fenac, toxicity to bluegill, 13070
paraquat, effect on bluegill in farm pond, 13296
sterox, toxicity to bluegill, 13070
stull invert oil, toxicity to bluegill, 13070
TD-47, toxicity to bluegill, 13070
TD-191, toxicity to bluegill, 13070
TD-266, toxicity to bluegill, 13070
toxic threshold values of, 14052
toxicities to certain freshwater crustacea, 14053
insecticides,
activity in resistant and susceptible mosquitofish, 13803
aldrin, magnification and degradation by invertebrates, 13933
apholate, hematological effects on channel catfish, 12072
^{14}C-DDT,
transformation and accumulation in flatfish, 12917, 12918
uptake, distribution and elimination in trout, 12790
^{14}C-dieldrin,
fed to goldfish, uptake and distribution, 13543
uptake, distribution and elimination in trout, 12790
carbaryl, toxicity to 4 salmonids, 13799
DDD residues in St. Lawrence River ecosystem after application, 12812
DDT,
conversion to DDD by gut microflora of anchovy, 12855
DDE and DDD,
effects of salinity on uptake by fish, 13371
residues in Saskatchewan River fish, re blackfly control, 13125
delayed mortality of Atlantic salmon after forest spraying, 13817
effect,
of fish size on uptake from water, 13790
on activity of lateral-line nerve of rainbow trout, 13773
effects of forest spraying on Atlantic salmon, 13822
food chain model for kinetics in freshwater marsh, 13263
in,
fishes of southern Arizona, 13843
rainbow trout of 3 New Zealand lakes, 13428
winter flounder, Weweantic River estuary, 13353
interactions with other insecticides, re residues in trout, 13378
magnification and degradation by invertebrates, 13933
metabolized by microorganisms from Lake Michigan, 13815
possible mortality from, in young rainbow trout, 13994
re,
disrupted osmoregulation in eel intestine, 14062
serum amino acids in rainbow trout, 13778

Biocides, cont.
insecticides,
DDT,
residues in,
Canadian Atlantic fishes, 13120
channel catfish in Nebraska, 13840
estuarine fauna, significance, 13421
fishes of,
California estuaries, 12921
estuary near Pensacola, Florida, 13841
toxicity to,
five semi-tropical fishes, 13501
four salmonids, 13799
dicapthon, LAS re toxicity to fathead minnow, 13372
dieldrin,
blood and brain concentrations at death of sunfish, 13880
effects on,
isolated-perfused gills of rainbow trout, 13965
SGOT in mollie, 13106
in,
fishes of southern Arizona, 13843
rainbow trout of 3 New Zealand lakes, 13428
winter flounder, Weweantic River estuary, 13353
interactions with other insecticides, re residues in trout, 13378
re serum amino acids in rainbow trout, 13778
residues in,
channel catfish in Nebraska, 13840
fish in California estuaries, 12921
toxicity to 5 semi-tropical fishes, 13501
endrin,
absorption by bluegill, 13472
chronic poisoning in goldfish, 13342
in vitro effect on succinic dehydrogenase, 13803
lesions in chronically exposed cutthroat trout, 13980
residues in fish in California estuaries, 12921
toxicity to 4 salmonids, 13799
EPN, LAS re toxicity to fathead minnow, 13372
guthion, LAS re toxicity to fathead minnow, 13372
heptachlor,
in,
rainbow trout of 3 New Zealand lakes, 13428
winter flounder, Weweantic River estuary, 13353
toxicity to aquatic life, 12879
lindane,
in rainbow trout of 3 New Zealand lakes, 13428
toxicity to,
five semi-tropical fishes, 13501
striped bass fingerlings, 13297
malathion,
effects on isolated-perfused gills of rainbow trout, 13965
toxicity to,
bluegill, chronic, 13398
four salmonids, 13799
striped bass fingerlings, 13297
methoxychlor,
acute toxicity to fish and breakdown studies, 13725
interactions with other insecticides, re residues in trout, 13378
methyl parathion, and LAS re toxicity to fathead minnow, 13372
parathion,
and LAS re toxicity to fathead minnow, 13372
inhibition of ACLE in fish, effect of sesamex on, 13781
sterilization of guppy testes, 13402

Biocides, cont.
insecticides,
phosphamidon, effects of forest spraying on Atlantic salmon, 13822
problem in Great Lakes, especially DDT in coho salmon, 13884
resistant fish, possible selective mechanisms in development, 13366
ronnel, LAS re toxicity to fathead minnow, 13372
rotenone, effects on isolated-perfused gills of rainbow trout, 13965
sumithion, effects of spraying on salmonids, 13373, 13822
toxaphene, in fishes of southern Arizona, 13843
trichloronat, and LAS re toxicity to fathead minnow, 13372
trithion, and LAS re toxicity to fathead minnow, 13372
molluscicides, frescon, for control of snail hosts of Diplostomum spathaceum, 14105
pesticides,
Bayluscide, toxicity to striped bass fingerlings, 13297
Co-ral, toxicity to striped bass fingerlings, 13297
effects,
in estuaries, 1969 research, BCF Station, Florida, 13009
on biota of Chew Valley Lake, England, 14165
model ecosystem for rating pesticide biodegradability and magnification, 14008
pentachlorophenol,
determination in organic tissues and water, 13399
influence on coho fatty acids, 13427
persistence in river water, 14206
persistent-, in environment, review, 13997
polychlorcamphene, consequences of entry into fishery waters, 13914
sensitivity in three generations of sheepshead minnows, 13385
sodium pentachlorophenate, toxicity to carp re temperature, 13905
susceptibility of fish, evaluation method, 12071
toxic substances demonstrated using Lebistes reticulatus, 13190
piscicides,
antimycin, effects of physical and chemical conditions on detoxification, 13170
for fishes in pest situations, 12876
glenodinine, produced by dinoflagellate Peridinium polonicum, 12923
33 NCS, toxicity to freshwater fish and sea lamprey, 12971
nitrosalicylanilides, 29, toxicity to 8 species of fish, 12970
polychlorpinene, reclamation of lakes by chemical method, 12963
reclamation of waters, FAO review, 13130
rotenone,
changes of toxicity to trout with time, 13860
surfacing of dead fish after application, 12802
sodium cyanide, observations on use in stream surveys, 13903
toxaphene,
gas-chromatographic analysis in waters, fish, sediments, 13400
role of lake sediments, water chemistry of, 14167
poisons,
chlorine for disinfecting water containing Ceratomyxa shasta, 13301
copper,
blood changes in exposed brook trout, 13109
solutions, bioassay against salmon eggs, fry, 13077
mercury,
compounds, conversion to methylmercury in nature, 13422
contamination of environment in Sweden, 13423
detection in fish killed by pollution, 13218
determination in fish by neutron activation analysis, 13721
estimation in Lake St. Clair walleyes, 13558
in,
fish, hazards to humans, 13614
marine environment, 13420
the environment, 13518
pollution in Sweden, re aquatic habitat, 13578
retention by salmon, 12988

Biocides, cont.
poisons,
methylmercury,
determination in fish, 14020
pathways into fish, 13364
methoxyethylmercuric chloride, toxicity to Oryzias latipes, 13232
phenol, toxicity to 5 semi-tropical fishes, 13501
PMA, toxicity to Oryzias latipes, 13232

Chemical factors,
alkalinity of natural waters, 14060
ammonia-intoxicated carp, N-ammonia and N-urea in blood serum and brain of, 13906
ammonium,
-nitrogen analysis in seawater aquaria, 13944
univalent cation glass electrode for rapid determination, 13937
BOD production of channel catfish, 12989
brackish water, effects on "ich" in channel catfish, 13004
cadmium, physiological responses of mummichog, 13338
carbon dioxide,
effect on carp palatal chemoreceptors, 13753
tension, reactions of young salmonids to sudden changes, 13697
carbon monoxide, exposure of trout, re oxygen uptake, transport, 13240
chemical characterization of experimental lakes, Canada, 13587
chemistry of natural waters, fundamental relationships, 14016
chlorine, dissolved-, free-, automatic detection, 13509
copper,
long-term exposure re survival, growth, reproduction of brook trout, 13931
oxygen consumption by bluegills exposed to, 14017
effects of dichlobenil on, in pond, 14054
heavy metal contamination of Canadian freshwater fish, survey, 13943
mercury,
determination of submicrogram quantities in lake water, 13203
estimation in Lake St. Clair walleyes, 13558
in the environment, 13518
methylmercury, pathways into fish, 13364
minor elements, survey in surface waters of United States, 13581
nitrogen,
dissolved, effect,
of dam, Columbia River, 12786
on salmonids in Columbia and Snake Rivers, 13925
supersaturation re thermal tolerance of juvenile salmon, 13193
oxygen,
activity response to, in brook trout, 12821
conditions during egg incubation, polarograph for observing, 13534
consumption in ammocoetes of mountain brook lamprey, 12819
content, reactions of young salmonids to sudden changes, 13697
-deficient water, detection by testing plant materials, 13082
diel, prediction of minimum in ponds with macrophytes, 13299
different conditions re survival and development of pike embryos, 13048
dissolved,
and sulfite liquor effect on juvenile salmon, Bellingham Bay, Wash., 13909
effects on early development of Pacific cod, 14036
night aeration of reservoir for suitable conditions for trout, 13887
re,
growth, development of salmon embryos, fry, 12815
survival and hatching of eggs, 13506, 13973
low,
re survival and behavior of ammocoetes, 12820
response of respiratory pumps in rainbow trout, 13446

Chemical factors, cont.
oxygen,
re winterkill survival variability in yellow perch, 13426
regime, experimental lakes, Canada, 13586
superabundant, re thermal tolerance of goldfish, 12818
tension, re vertical migration of Chaoborus, 12859
utilization and N and P regeneration in decay of aquatic weeds, 14223
oxygenation possibilities for large polluted rivers, 14176
pH,
effect on reactions of O_2 and CO with carp hemoglobin, 13452
influence on efficacy and residues of quinaldine in bass, 14149
low-, effect on survival and emergence of aquatic insects, 14014
reactions of young salmonids to sudden changes, 13697
phosphorus,
dynamics in Chupei fish ponds, 13945
uptake from water by tilapia, 13165
re,
antimycin detoxification, 13170
phytoplankton production in experimental lakes, Canada, 13589
response of Chinese carps to, 12975
salinity,
adaptation by different races of stickleback, 13820
and temperature re development of flatfish and cod eggs, 13720
effects on,
early development of Pacific cod, 14036
embryonic development of sole, 13934
oxygen consumption of rainbow trout, 14209
re,
culture of Dungeness crab larvae in laboratory, 13380
survival and growth of pre-smolt coho salmon, 13618
toxicity of ammonia to striped bass and stickleback, 13902
uptake of DDT, DDE and DDD by fish, 13371
tolerance of blue- and channel catfish, 13964
salt water influence on ATPase activity in coho gills, 13112
water,
chemistry of toxaphene role of lake sediments, 14167
hardness and environmental factors, effect on fish in Rio Grande River, 13603
quality,
and trophic conditions of Lake Superior, 13246
of California streams re logging, 14156
zinc, toxicity to cutthroat trout, re productivity of Coeur d'Alene River, 13665

Chemicals,
aroclor 1254 in Escambia Bay, Florida, 12894
cadmium, physiological responses of mummichog, 13338
carbon monoxide, exposure of trout, re oxygen uptake, transport, 13240
carcinogens, fed to fish, pathology, 13988
chlorine, for disinfecting water containing Ceratomyxa shasta, 13301
copper sulfate as fish medication and algicide, 13195
EDTA, re exchange of Ca and Sr from water in metabolism by fish, 13630
formaldehyde, identification in aquatic animals by chromatography, 13217
HB-40, fish toxicity, 12886
hydrogen sulphide, toxicity to juvenile fish and fish eggs, 13499
LAS,
factors affecting toxicity to bluegill, 13169
for chemical skinning of fish, 13230
mercury, retention by salmon, 12988
methylmercury,
determination in fish, 14020
pathways into fish, 13364

Chemicals, cont.
methoxyethylmercuric chloride, toxicity to Oryzias latipes, 13232
33 NCS, toxicity to freshwater fish and sea lamprey, 12971
nitrilotriacetate, acute toxicity to fry and crustaceans, 13442
nitrosalicylanilides, 29, toxicity to eight species of fish, 12970
NTA as anti-pollutant protecting fish from copper, zinc, 12875
PEFA, for chemical skinning of fish, 13230
phenol,
for extracting nucleic acid from fish muscle, liver, 13208
toxicity to five semi-tropical fishes, 13501
phenylmercuric acetate, toxicity to Oryzias latipes, 13232
polychlorinated biphenyls, solubilized in water by surfactants for toxicity studies, 13390
potency vs. fish, method for rating, 12969
santowax OM plus 30% high boilers, fish toxicity, 12886
SE, for chemical skinning of fish, 13230
sodium,
cyanide, observations on use in stream surveys, 13903
molybdate, influence on trout and fishing, Castle Lake, Calif., 13075
yellow phosphorus production wastes, toxicities to fish in sea water, 14028

Competition,
bass, yellow, young vs. adults for food, 12794
food-, sockeye salmon fry vs. sticklebacks, Wood River lakes, Alaska, 13631
predatory demersal fish in Hauraki Gulf, New Zealand, 13995

Culture,
acidification of aquarium water re sand filtration, 13207
aeration of carp wintering ponds at critical times, 14117
air-economizer apparatus for use in fish work, 13474
amur, white, stocked alone in ponds and with other species, 13960
anchovy, northern, induced spawning of, 13806
aquaculture bulletin, FAO, 13260
Atherina boyeri, preliminary research on artificial propagation, 13660
bait fishes in the United States, 13356
bass, striped,
biology of eggs, larvae, young, re planting in USSR, 13465
report on fry production and rearing, Georgia hatchery, 14181
biostimulators: lysine and terramycin, re growth and condition of market fish, 13361
boom applicator for aquatic herbicides, 13512
brine shrimp feeder, automatic, 13516
cage-, channel catfish, Auburn Univ. Ext. Service, 13119
carp,
biotin requirement, 13204, 13266
digestibility of nutrients in feeds, 13529
effects of alpha-tocopherol deficiency, 13235
grass, reared with other carps, food interrelationships, USSR, 13677
selective and intensified breeding in ponds, USSR, 13094
silver,
initial results of breeding in ponds of Israel, 13658
reared with other carps, food interrelationships, USSR, 13677
yield re source and concentration of dietary protein, Israel, 14010
young, alpha-tocopherol requirement, 13279
catfish,
Auburn Univ. Ext. Service, 13136
channel, temperature and photoperiod re growth, food consumption and conversion, 13579
cells of goldfish at high temperatures, 13052
century of fisheries in North America, 14018

Culture, cont.
chironomid larvae as food for fish fry, 13659
chlorine, dissolved-, free-, automatic detection, 13509
closed systems and the rearing of fish larvae, 13719
conversion efficiency formulae, 13212
use in breeding fishes, 13213
copper sulfate as fish medication,and algicide, 13195
cryo-preserved sperm for fertilization of salmon eggs, 13935
cyprinid broodstocks held in lagoon fish farms, 13673
directory of fish culture research institutions, 13927
disinfection of water with UV and chlorine, re Ceratomyxa shasta, 13301
Dungeness crab larvae in laboratory, 13380
ectoparasite control with masoten, 13183
eel,
European, growth in freshwater ponds re sex, 13842
thiamine deficiency symptoms, 13273
eggs of plaice, flounder, Baltic cod re temperature and salinity, 13720
elvers in aquaria, 13434
FAO Fish Culture Bulletin, 13744, 13745
feeding of dried crustacean waste for pigmentation of brook trout, 13858
fish,
farm enclosures - use of standard frame units, 12854
food distributor for hatchery raceways, 13471
in ponds, relationship of P and N through plankton, 13921
food consumption, daily-, of young pikeperch and roach at fish farms of USSR, 13528
gill hyperplasia, systematic grading of, 13312
herbivorous fish, and use for weeding reservoirs, 14055
herring, lake-, in laboratory, 12999
immunization against furunculosis, testing antigenicity of vaccine, 13298
incubation, egg-, polarograph for observing oxygen conditions, 13534
laboratory-, of desert pupfish, 13161
mariculture and genetics, 13480
marine,
animals in tidal currents, trichterkreisel device for, 13718
fish farming, Helicostoma as problem parasite in, 14172
menhaden, yellowfin-, larvae, 13050
methods, Huet's treatise, 13459
milkfish ponds, silicate added to increase benthic algae, 13920
mullet,
gray, induced breeding of, 13918, 13919
preliminary experiments on artificial feeding, 13717
muskellunge, injection of dried pituitary into carp to control spawning, 13507
nitrogen-gas disease, catastrophe at Oregon hatchery, 13883
parasitosis by Lernaea cyprinacea in aquarium fish, Lebistes reticulatus, 13661
phosphorus dynamics in Chupei fish ponds, 13945
plaice,
O-group-, growth on diets containing different protein levels, 13716
prolarvae, effect of temperature on growth efficiency, 13956
pollution potential of salmonid hatcheries, 13470
pompano, juvenile, toxicity of treatment compounds, 13504
pond-, re behavior of northern pike fry, 13002
ponds,
amur-, fish-breeding-, efficacy of organic fertilizers, 12907
rectangular, circulating, re "ich" control, 13005
salmon,
Abernathy diet, 13503
Black Sea-, fed with food mixture with paste of crustaceans, 13913
chinook, fingerlings, temperature effects on growth, form and hematology, 13295

Culture, cont.
salmon, cont.
chum,
to increase Sakhalin stocks, 13466
tolerance to fresh water of adults reared in salt water, 13611
pink, to increase Sakhalin stocks, 13466
populations, sex ratios and survival estimates, 13599
sockeye, satiation time, appetite, maximum food intake, 13621
salt treatment,
for separating bad eggs from good- of chum salmon, 13834
of chum salmon eggs,
most suitable time during eyed stage, 13836
re appearance of dead eggs and other phenomena, 13835
sanitary requirements in modern fish farming, 13747
seawater system, open-, with salinity and temperature control, 13298
sexing adult largemouth bass externally, 13302
shad, threadfin, excelsior mats used successfully for spawning and transportation of eggs, 13966
shemaya, description of broodstock, USSR, 13523
simulated-, food habits of bigmouth buffalo, 13066
snail destruction with frescon for control of Diplostomum, 14105
spawning,
artificial, of,
black seabass with CG hormones, 13772
walleye, muskellunge, pike, using MS-222, 12991
carp, laboratory technique for, 13300
channel, Rocky Reach-, for chinook salmon, evaluation, 13638
sterilizer, water-, for egg incubators, 13468
sturgeon fry, conditions and prospects for, Volgograd, USSR, 12825
sucker, white, eggs, at different oxygen levels, 13973
system for marine fish larvae, 13972
tilapia (2 species) in fish ponds, 14107
transport, fish-, irrigation pipe for, 13309
trout,
farms of Italy, present status, 13850
growth-control technique, 13310
hatchery design and construction in Pennsylvania, 13500
in vertical units, 12986
rainbow,
effect of freezing and aging on spores of Myxosoma cerebralis, 13508
importance of contact with air, 13533
vimba, description of brookstock, USSR, 13523
walleye eggs, survival and hatching at different oxygen levels, 13506
warmwater-, in closed circuit system, 14171

Diet,
Abernathy-, salmon-, 13503
-tocopherol,
deficiency,
effects on carp, 13235
in carp, protein composition of dystrophic muscle, 13847
requirement of young carp, 13279
amino acids and peptides addeded to food mixture, 13917
arginine requirement of chinook and coho salmon, 12850
biostimulators: lysine and terramycin, re growth and condition of market fish, 13361
biotin requirement of carp, 13266
chironomid larvae as food for fish fry, 13659
containing different protein levels, re growth of O-group plaice, 13716
crustacean waste, dried-, for pigmentation of brook trout, 13858

Diet, cont.
different feeds re physiological condition of young sturgeon, 13743
dry-, feeding experiment on rainbow trout in net cages, 12813
feeds, fish-, method for measuring digestibility and metabolizable energy of, 13963
food mixture with paste of crustaceans, for salmon, 13913
gossypol, effects on rainbow trout, 12805
herring, lake-, cultured in laboratory, 12999
histidine requirement of chinook and coho salmon, 12850
medicated, phenosal in pellets for cestode control, 13363
menhaden, yellowfin-, larvae, reared artificially, 13050
mullet-, preliminary experiments on artificial feeding, 13717
nutrient content,
in carp feeds, digestibility, 13529
of offal from fish cultures, 12804
nutritive value of free amino acids, young carp, 13223
protein,
from plants and other sources fed to plaice: growth effects, 14040
source and concentration re carp yield, Israel, 14010
utilization by young carp, 13220
rainbow trout, evidence for non-essentiality of ascorbic acid in, 13967
sprat-, fed to rainbow trout - blood changes, 13748
thiamine deficiency symptoms in eel, 13273
vitamin protein food paste, biochemical value of, 13916

Disease,
Aeromonas,
hydrophila, incidence in yellow perch, Quebec, 14101
increase in bodies of dead fish, 13653
liquefaciens,
drug resistance factors, detection of, 14174
immunofluorescent detection in fish in lunar exposure studies, 14140
punctata, in grass carp, chloramphenicol for control, 13922
α-tocopherol deficiency in carp, protein composition of dystrophic muscle, 13847
argulosis, control with masoten treatment, 13851
blind striped bass from Delaware River estuary, 12873
cases, 5-year summary at S. E. Coop. Fish Disease Lab., 14170
Ceratomyxa shasta, eradication from water by UV and chlorine, 13301
columnaris,
bacterium from pond-cultured eels, 13211
influence of Columbia River fish ladders, 13869
control in eggs and fishes with UV, 13146
deficiency of α-tocopherol, effects on carp, 13235
diabetes mellitus, ultrastructure of pancreatic islets, carp, 13258
diseases, principal-, of marine fish and shellfish, 12851
Egtved virus: antibodies in serum from infected rainbow trout, 14035
Epistylis epizootics of fish in southeastern United States, 13983
epizootics, at Japanese trout stations, etiology and histopathology, 13723
fibroma, subcutaneous, in lake trout, Canada, 13625
fin degeneration in young Lake Michigan alewives, 13047
fish-, economic importance of, 14024
changes in endogenous lipids, 13535
economic importance of, 14024
fungus epizootics in flounder caused by Ichthyophonus, 13438
furunculosis,
in,
nonsalmonids, 13339
salmonids, carofur for control, 13652
testing vaccine antigenicity for immunization, 13298

Disease, cont.
gill-,
bacterial-, in rainbow trout, efficacy of two ammonia compounds against, 13849
re Chondrococcus columnaris in pond-cultured eels, 13269
Haemogregarina in carp blood, pathology,of, 13690
hexamitiasis of rainbow trout, etiology and histopathology, 13724
hyperplasia, gill, systematic grading of, 13312
"ich", effects of brackish water on, in channel catfish, 13004
infectious pancreatic necrosis virus, 14006
IPN
-like disease of rainbow trout, etiology and histopathology, 13724
Swiss albino mouse as host for virus, 13477
lernaeosis, control with masoten treatment, 13851
lesions, histopathological-, in cutthroat trout chronically exposed to endrin, 13980
lymphocystis in,
Chesapeake Bay striped bass, 12882
croaker and seatrout, Mississippi estuaries, 12885
lymphosarcoma,
cell-free transmission in northern pike, 12827
of thymus of salmonids, 13664
neoplasm, hematopoietic, suggesting leukemia, in cutthroat trout, 13127
nitrogen-gas-, catastrophe at hatchery in Oregon, 13883
ophthalmic pathology, chronic-, in lake trout, ocular oxygen concentrations with, 13742
papilloma in European eel, re tumorgenesis, 13182
parasitosis by Lernaea cyprinacea in aquarium fish Lebistes reticulatus, 13661
pathogens,
bacterial-, of fish, DS-677K effective against, 13760
immune resistance of fish re temperature, 13823
pathology of fish fed aflatoxins and other antimetabolites, 13988
prophylactic measures in stocking new fishes in waters, 13381
pseudomonad,
from rainbow trout lesions, proteinase properties, 13395
proteolytic-, from skin lesions of trout, morphology, 13158
pugheadedness in vermilion snapper, Gulf of Mexico, 13573
red-, of European eel in German Bight, 13184
Sacramento River Chinook-, specifics and control, 13367
sekoke disease (diabetes) in cultured carp,
response to mammalian insulin, 13845
some metabolic aspects, 13846
sockeye salmon virus, species specificity and cytopathology in salmonid cells, 13382
soft-egg-, and acriflavine, 13977
swimbladder,
inflammation of carp, etiology and pathogenesis, 13357
of carp, histopathological changes in, 13946
UDN,
healing of salmon under experimental conditions, 13485
in brown trout, serum protein changes associated with, 13484
-infected salmon, immune response to Saprolegnia, 12807
new disease of salmonids in Central Europe, 13948
sequential pathology of lesions, 12810
vibriosis,
an epizootic in chinook salmon, 12840
in Pacific salmon cultured in Canada, taxonomic status of bacterium, 13868
virus,
replication of four selected viruses in two salmonid cell lines, 12839
sockeye salmon-, properties, 12844
whirling-,
caused by Myxosoma cerebralis, in salmonids of United States, 13663

Disease, cont.
whirling-, cont.
effect of freezing and aging on spores of Myxosoma cerebralis, 13508
present status in Italian trout farms, 13850
spreading into native trout populations in Michigan, 14077

Distribution,
albacore,
in Indian and Atlantic Oceans, 13383
on North Pacific longline grounds, 12838
Anguilla recorded from California, 13329
Argulus, occurrence in Scotland, 13493
benthos, re artificial destratification in El Capitan Reservoir, 13080
billfishes in Atlantic Ocean, 13387
checklist of fishes in Buttonwood Canal, Florida, 13257
cobia, prejuvenile and juvenile, Gulf of Mexico, 13250
crappie, white, vertical, in Lake Texoma, 13291
croaker, Atlantic, in Gulf of Mexico nursery areas, 14019
Danube River fishes, 14114
demersal fishes off Louisiana and Texas, by season, 14198
depth-,
seasonal-, salmonids and alewives, Echo Lake, Maine, 11833
zooplankton, effects of artificial destratification, 13567
exotic fishes introduced into North America, 12968
fish fauna of Leaf River, Ungava, 13828
flounder, yellowtail, Newfoundland area, 13345
freshwater fishes of northwestern Canada and Alaska, 13330
galaxiid fishes of New Zealand, 13617
invertebrates, in freshwater reservoir, USSR, 12913
larvae, fish-, kinds and abundance in eastern tropical Pacific, 13159
mackerel,
Atlantic, juvenile and spawning, in S. E. Newfoundland waters, 12951
Japanese, aggregation of, re environmental conditions, 14183
larvae and juveniles in western North Atlantic, 13981
macroinvertebrates, non-insect-, cluster analysis in upper Potomac River, 13852
macrozoo-, and small nekton, off Vancouver Island and Washington, 1963, 13333
marine fishes of Virginia's eastern shore, 13238
menhaden, Atlantic, larval-, at two North Carolina inlets, 13548
Missouri fishes, 14186
Nocomis of eastern United States, 13992
perch, Pacific Ocean-, bathymetric, re reproduction, 13622
platy, variated, addition to California fauna, 13600
Poecilia sphenops complex in Mexico, 13950
Poeciliopsis monacha-occidentalis, all-female form in northwestern Mexico, 13855
pupfish, new locality for, California, 13593
range, altitudinal extension, fathead minnow, 13253
rockfishes, especially Pacific Ocean perch, in N. E. Pacific, 13097
sailfish, 5 juveniles from eastern tropical Pacific, 12935
salmon,
chinook,
marked, from Columbia River hatcheries, in marine fisheries, 13058
occurrence in Kings River, California, 13321
chum, in Okhotsk Sea, especially re immatures, 13648
in,
North Pacific and related oceanographic features, 13853
winter re currents and waters of N. E. Pacific, 12785
juvenile, in Brownlee Reservoir, 1962-65, 13496

Distribution, cont.
salmon, cont.
sockeye,
in Lake Aleknagik, Alaska, 1962, 13632
surveys of spawning populations, Bristol Bay, Alaska, 13637
Washington, re pulp mill sulfides, 12880
sculpins in Montana, 12939
Sebastes variegatus, new scorpaenid from northeastern Pacific, 13810
shiner, bigmouth, first Canadian record of, 13829
smelt,
in Lake Erie, 13101
landlocked, seasonal, in Rybinsk Reservoir, USSR, 13532
snappers (Fam. Lutjanidae), 14120
snook in North Carolina waters, 13262, 13750
spatial, pelagic fishes in Lambarfjärden, Sweden, 13561
spot, and biology in Gulf of Mexico nursery areas, 14019
sturgeon larvae in Sacramento-San Joaquin River system, 13074
sucker, white, influence of light and dark periods, 13566
trematodes, larval, in part of Lake Champlain, re fish hosts, 13689
trout,
and char in small Swedish high mountain lake, 13696
brook, further observations, 13627
cutthroat, fluvial and adfluvial, in St. Joe River, Idaho, 14058
lake, postglacial, re intraspecific variations, 13861
rainbow, world, 13932
tuna, skipjack, in Eastern Pacific re surface temperature, 14026
tunas,
and marlins in Atlantic Ocean, 13389
larval, Gulf of California, 12896
vertical-, pelagic fishes in some Polish lakes, 14108
zooplankton,
crustacean-, in alpine and subalpine lakes, Canada, 13615
in Canton Reservoir, Oklahoma, 13264

Drugs,
acriflavin,
and soft egg disease, 13977
toxicity to,
juvenile pompano, 13504
striped bass fingerlings, 13297
carofur, for control of furunculosis in salmonids, 13652
CG,
hormones for spawning of black sea bass, 13772
human-, re induced spawning of northern anchovy, 13806
chloralhydrate, anesthetic effects on tilapia, 13255
chloramphenicol, for Aeromonas control in grass carp, 13922
chlorbutol, anesthetic effects on tilapia, 13255
chlortetracycline, effect on trematode in mullet flesh, 13610
copper sulfate,
as fish medication and algicide, 13195
toxicity to juvenile pompano, 13504
cupravit, inhibition of enzyme activity in trout, whitefish, 13439
diamox, effect on ion flux across brook trout gas bladder, 13782
dimethyl sulfate, effect on rainbow trout sperm, 13035
DP-1166, potent anesthetic for fish, 13756
DS-677K, effective against bacterial pathogens of fish, 13760
fardi 7, efficacy against bacterial gill disease in trout, 13849
formaldehyde, identification in aquatic animals by chromatography, 13217
formalin, toxicity to juvenile pompano, 13504
gonadotropin,
human-, chorionic-, injection re prespawning behavior of sunfishes, 13261
mammalian-, chorionic-, for striped bass reproduction, 14181

Drugs, cont.
gonadotropin, cont.
salmon-,
injected into mullet, blood changes, 13779
spermiation of goldfish as bioassay for, 13396
insulin, mammalian-, effect in cultured carp with sekoke disease (diabetes), 13845
lysine, as biostimulator, re growth and condition of market fish, 13361
malachite green,
inhibition of enzyme activity in trout, whitefish, 13439
oxalate, toxicity to striped bass fingerlings, 13297
re changes in gills of rainbow trout, 14003
treatment of UDN infected salmon, 13485
masoten, to control fish ectoparasites, 13183
methallibure, for identification of teleosts gonadotrope cells, 13634
methyltestosterone, salmon-, injected into mullet, blood changes, 13779
MS-222,
anesthetic effects on tilapia, 13255
anesthetization and handling, effects on brook trout, 13928, 13929
as spawning aid for pike, walleye, muskellunge, 12991
dynamics in blood and brain of anaesthetized fishes, 13034
effects on,
electrolyte and water content in rainbow trout brain, 13037
isolated-perfused gills of rainbow trout, 13965
residue identification in fish tissues by chromatography, 13036
sampling of fish muscles for residue, 13128
nitrosomethyl urea, effect on rainbow trout sperm, 13035
oestradiol 3-benzoate, re egg proteins in cod serum after injection, 13800
ouabain, alteration of coho salmon gill ATPase activities after injection and saltwater adaptation, 13722
oxytetracycline, effect on trematode in mullet flesh, 13610
phenosal, in medicated feed for cestode control, 13363
phentolamine, re adrenalin activity on lateral muscle of rainbow trout, 13740
pituitary,
carp-, re induced spawning of northern anchovy, 13806
dried-, injection into carp to control spawning time, re muskellunge culture, 13507
extract,
effect on maturation of female pikeperch, 14121
fractionated-, fish-, for induced spawning of carp, 14102
injected for breeding of Indian carps, 13001
salmon-, re induced spawning of northern anchovy, 13806
potassium permanganate, toxicity to juvenile pompano, 13504
prolactin, fattening response to, in killifish held on different photoperiods, 14081
propanolol, re adrenalin activity on lateral muscle of rainbow trout, 13740
propoxate, anesthetic effects on tilapia, 13255
propylene phenoxetol, anesthetic effects on tilapia, 13255
quinaldine,
anesthetic effects on tilapia, 13255
as anesthetic for Pacific intertidal fishes, 12801
as spawning aid for pike, walleye, muskellunge, 12991
influence of pH on efficacy and residues in bass, 14149
-MS-222, synergic mixtures as trout and pike anesthetics, 12992
sampling of fish muscle for residues, 13128
uptake and excretion by nurse sharks, 14046
sesamex, effect on ACLE inhibition by parathion in fish, 13781
sodium pentobarbital, effect on temperature selection response of guppies, 14205
terramycin,
as biostimulator, re growth and condition of market fish, 13361
concentrate, toxicity to striped bass fingerlings, 13297
thiourea, for identification of teleost gonadotrope cells, 13634

Drugs, cont.
urethane, anesthetic effects on tilapia, 13255
vaccine, for immunization against furunculosis, antigenicity testing, 13298
water, brackish-, effects on "ich" in channel catfish, 13004
zephirol O. V., efficacy against bacterial gill disease in trout, 13849

Ecology,
adaptative problems associated with unisexual fishes, 13959
alewife, species interactions in Great Lakes, 12798
altered environment re condition and growth of carp and carpsucker, 13546
anchovy, northern, larvae, food density re growth and survival, 13447
aquatic ecosystems and ship canals, 14063
bass, striped,
biology of eggs, larvae, young, re planting in USSR, 13465
re pollution in Delaware River, 14067
bioassays to determine allowable waste concentrations in waters, 13575
biochemical adaptation to the environment, rainbow trout, 13771
carrying capacity of some N. California streams for juvenile salmonids, 13326
cave and spring fishes of southern bend of Tennessee River, 13910
cover, temperature, re salmonid movements in 2 Idaho streams, 14135
ecological,
information, application for pollution control in chemical industry, 13996
succession, impact on parasites of centrarchids in different lakes, 14112
ecosystem,
Connecticut River-, effect of thermal pollution, 13425
marine-, chlorinated hydrocarbons in, 13419
of eutrophic lake, stream of energy in, 12811
of Lake Dal'neye, analog model of, 13454
effects of,
dichlobenil on pond factors, 14054
gravel cleaning on benthos in 3 Alaskan streams, 13513
heavy metals on marine and estuarine organisms, 13577
oil from foundered tanker on fish and invertebrates, 14048
environmental,
factors influencing activity of mullet spermatozoa, 13482
influences on extended spawning of rainbow trout, 13553
eutrophication in U. S. lakes, ecological response to human activities, 14161
exchange equilibria control biological magnification of chlorinated hydrocarbons in lentic environment, 13542
experimental lake studies, — rationale, background, and development, Canada, 13582
fish,
associated with drifting kelp, Southern California, 13317
Buttonwood Canal, Florida, 13257
communities in Brier Creek, Okla. during summer, 13713
fauna,
of Leaf River, Ungava, 13828
of new lake near Vere, Netherlands, especially plaice, 14005
in pest situations, 12876
within inland waters of Horn Island, Mississippi, 12884
food of juvenile herring, seasonal variations in, Maine, 13191
freshwater effects on fertilization and development of herring eggs, 13032
grayling, Baikal', black-, young, 13456
habitat,
segregation in Sanguinicolid blood flukes of Pacific rockfishes, 14037
selection in fourspine stickleback, 13201
heated water in cooling reservoirs, beneficial uses, 13424
herring larvae, seasonal variations and conditions, Maine, 13108
Hexagenia naiads in Okla. reservoir, 13067
ide in River Kävlingeån, Sweden, 13556

Ecology, cont.
interaction of brook- and brown trout in a stream, 13827
limiting factors re fish abundance, 13142
mackerel, Japanese, in early life stages, re population fluctuation, 14179
manmade reef-, 13691
mayflies of St. Maries River, Idaho, 13813
mercury,
compounds, conversion to methylmercury in nature, 13422
contamination of environment in Sweden, 13423
in,
environment, 13420, 13518
fish, hazards to humans, 13614
pollution in Sweden re aquatic habitat, 13578
microbial flora of stream-incubated salmon eggs, 13086
model,
ecosystem for rating pesticide biodegradability and magnification, 14008
food-chain-, for DDT kinetics in marsh, 13263
Mullet Pond, on barrier beach, North Carolina, fishes and changes, 13749
multivariate analysis for fishery biology, 13473
pesticides, persistent-, in environment, review, 13997
plants, aquatic-, vascular-, in southern Ontario impoundments, 13797
Poeciliopsis monacha-occidentalis, all female form in northwestern Mexico, 13855
pollution, water-, biological effects, 12898
re,
aggregation of adult Japanese mackerel, 14183
thermal pollution, 13168
salmon, masu, juveniles in a brook, 13832
schooling, fish-, methodological principles for study, 13459
sedimentation of salmonid spawning beds, effects of logging, 13316
sturgeon, lake-, 13552
sunfish, longear, repopulation of vacant section of stream, 12800
survey of factors affecting fish production in La. lake and river, 14189
temperature, stream-, effects of clear-cutting, 13011
thermal,
loading in New York Marine District, 13734
relations in sockeye salmon, 13768
trout, rainbow, importance of contact with air, 13533
tunas, larval, Gulf of California, 12896

Economics,
analysis of baitfish industry, Colorado River, 13084
evaluation of forecasts of sockeye run, Bristol Bay, Alaska, 13926
importance of fish diseases, 14024
Indian net fisheries, Columbia River, 12931
sports fishing enterprises and fishing dock operators, Okla., 13055

Electricity,
current,
alternating-, effect on fishes and invertebrates, 13144
direct-, re survival, growth and fecundity of hatchery rainbow trout after exposure, 14150
electrode chamber for recording respiratory movements, 13172
electrofishing, river-, and fish population estimates, 13975
electroshocker for young shad collection at hydroelectric intakes, 13306
lights for attraction of food organisms, USSR, 12912

Embryology,
bream, European, under deep-water conditions, 14128
circulatory system in eggs and larvae of some teleosts, 13044
development of Pacific cod, effects of salinity, temperature and D.O., 14036

Embryology, cont.
egg,
of plaice, flounder, Baltic cod, re temperature and salinity, 13720
size, key factors affecting rainbow trout, 14000
embryos, fish, uptake of bacterial H^3-DNA, 13704
fishes, and theory of individual development of organisms, 13460
flounder, White Sea-, 13674
Gambusia sp., chronological table of embryonic development, 13657
grunion, effect of temperature on development, 13327
herring,
fertilization and development of eggs in fresh water, 13032
White Sea-, re temperature, 12870
loach,
effect of anaerobiosis on cleavage ATP of eggs, 12979
triosephosphate metabolism in developing embryo, 12943
mullets of Israeli coast, 13824
pike embryos, survival and development under different oxygen conditions, 13048
ruff, development of sensory organs of lateral-line system, 13043
salmon,
chinook, X-rays and temperature re mortality and growth, 13545
chum, salt treatment of eggs re appearance of dead eggs and other phenomena, 13835
hybrids, sex-related parental influence on early development, 13340
sockeye, re physical environment, Iliamna Lake beach areas, 13636
sole, petrale, effects of salinity and temperature, 13934
sturgeons, metabolism in early life stages, 13139
teleost eggs, acrylamide gel as an embedding material, 14096
trout, rainbow, carbohydrate in egg protein, 13386

Equipment,
acrylamide gel as an embedding material for teleost eggs, 14096
aerator performance in natural streams, 13952
air-economizer apparatus for use in fish work, 13474
apparatus for rapid volumetric analysis of food of fishes, 13163
aquarium, acidification of water re sand filtration, 13207
atomic absorption, flameless-, for mercury determination in fish, 13605
barrier, plastic-, for spot treatment of vegetation, 13304
bathythermograph data plotted on computer printer, 13124
boom applicator for aquatic herbicides, 13512
brine shrimp feeder, automatic, 13516
calorimeter, Phillipson-, bomb modified for seasonal calorific values of zooplankton, 13874
catheterization,
of operculum for sampling expired water, 11831
procedure, improved-, vascular-, 13941
centrifuge, for separating food organisms from shad gut contents, 13244
chamber for separating brine shrimp nauplii from eggs, cases, 12994
chromatography, thin-layer, for identification of formaldehyde in aquatic animals, 13217
closed systems,
and the rearing of fish larvae, 13719
for warmwater pisciculture, 14171
computer printer, for plotting bathythermograph data, 13124
concave gradient elution for determination of fish muscle nucleotides, 13229
corer,
multiple-, for sampling profundal benthos, 13104
simple-, vs. Ekman grab for sampling shallow-water benthos, 13616
counter, sonar-, fish-, 13155
culture system for marine fish larvae, 13972
decalcification technique for sectioning pectoral spines, 13003

Equipment, cont.
determination of methylmercury in fish, 14020
device for,
fish recovery in turbine mortality studies, 13007
removing fish embryo from egg, 13123
study of energy use and physiology of swimming in fishes, 13537
electrode,
chamber for recording respiratory movements, 13172
univalent-, cation-, glass-, for rapid determination of ammonium in water, 13937
electroshocker, for young shad collection at hydroelectric intakes, 13306
enclosures, fish-farm-, the use of standard frame units, 12854
excelsior mats used successfully for spawning and transportation of threadfin shad eggs, 13956
explosives for frightening fish, 13684
fish-,
cage, marine design, 13510
guiding system, electrical-, water velocity re efficiency, 13498
fishway, for alewives, evaluation, Gaspereau River, Canada, 13667
food distributor for hatchery raceways, 13471
gas-chromatographic-, for toxaphene determination in water, fish, sediments, 13400
grab, Ekman- and Ponar-, comparison of effectiveness, 14152
immunofluorescent technique for detecting Aeromonas in fish in lunar-exposure studies, 14140
irrigation pipe for fish transport, 13309
laboratory, floating-, for study of aquatic organisms and their environment, 14169
ladders, fish-, influence on Chondrococcus columnaris, 13869
laser rays, for detection and analysis of chemical elements in tissue slices, 13608
lift net for catching bait fish attracted to light, 13541
light,
artificial, and 5-meter lift net for collecting coastal pelagic fishes, 13839
-control apparatus for experimental environments, 13215
for attraction of food organisms, USSR, 12912
liquid scintillation method for assaying ^{14}C,
activity in photosynthesis, 13588
-labelled benthic microflora, 13940
mercury-determination-, submicrogram quantities in lake waters, 13203
meter net for sampling perch and walleye fry, 13702
method for,
detection and estimation of sublethal poisoning in fish, 14076
measuring digestibility and metabolizable energy of fish feeds, 13963
microfilm reader for fish scale analysis, 12990
nets,
channel-, for catching larval fishes, 12919
sampling-, methods, for post-larval fish, macroplankton, 12856
small trap- and frame-, simplified tending thru use of zippers, 13969
neutron activation analysis for mercury determination in fish, 13721
orifice placement in turbine gatewells for bypassing salmonids, 13554
pentachlorophenol-determination, re organic tissues in water, 13399
photoelectric metood for recording melanophore responses, 13375
pipe, inclined-, passage of adult salmon and trout thru, 14138
plankton sizer, opto-electronic-, 13490
polarograph for observing oxygen conditions in egg incubation, 13534
procedures for,
lipid extraction from crude fish tissues, 13680
satisfactory disposal of mercury wastes from laboratories, 14065
recirculation system, saltwater-, at NMFS Lab., Miss., 14044
recording-measuring board for fish, 13000
reference system, inexpensive, for fishery biologists, 12997

Equipment, cont.
reflectance method for measuring melanophore responses, 13370
respiration chamber for fish, continuously monitored, 13873
respirometer, 13303
comparison of two for measuring oxygen consumption of fish, 14004
sampler,
egg- and fry-, hydraulic, 13640
flow-thru-, gauze-, for recovering virus from waters, 13801
free-vehicle-, bottom-water-, 13436
quantitative-,
artificial-substrate-, for benthos, 13251
plankton-, 14175
sled-mounted-, suction-, for benthos, 13008
sampling device, constant-fraction-, for enumerating juvenile salmonids, 13979
screens,
for diverting juvenile salmon from turbine intakes, tests of, 14137
traveling, for diversion and collection of juvenile fish, 13365
seawater system, open-, with salinity and temperature control, 13293
sieve and trough for washing substrate samples on a boat, 13514
spectrophotometry, flameless atomic absorption, for mercury determination in food, fluids, 13609
sterilizer, bactericidal-, water-, for fish egg incubators, 13468
structures, artificial-, for attracting coastal pelagic fishes, 13181
substrate, basket-type-, artificial-, for sampling benthic macroinvertebrates, 14151
suction device, portable-, underwater-, for fish egg and larvae collection, 13305
sugar flotation for separating zoobenthos, evaluation, 12996
surface-active agents for removing fish skin, 13230
syringe procedure for transfer of nanogram quantities of mercury vapor for analysis, 13857
tag, transponding-, acoustic-, tracked with sonar, 13328
tagging gun for marking flatfish, 13433
technique for measuring ammonium-N in seawater aquaria, 13944
tool for collecting burrowing aquatic animals, 13437
trichterkreisel device for culturing marine animals in tidal currents, 13718
troughs and redds for study of salmon fry, 13062
trout hatchery design and construction in Pennsylvania, 13500
trypsin modification of Sihler technique of staining nerves for systematic study of fishes, 14082
vertical units for trout culture, 12986
water delivery system for small fish holding tanks, 12795

Estuaries,
Bellingham Bay, Wash., effect of water quality on juvenile salmon, 13909
biological significance of, symposium on, 14023
Bristol Bay, Alaska,
economic value of forecasts of sockeye run, 13926
surveys of sockeye spawning populations, 13637
Buttonwood Canal, Fla., checklist of fishes, 13257
California-, chlorinated hydrocarbon residues in fish, 12921
Casco Bay, Maine, heat budget re circulation, 13344
Chesapeake Bay,
lymphocystis in striped bass, 12882
primary production, 12872
Danube-, planktonic crustaceans parasitic to fish, 12916
Delaware River Estuary, blind striped bass, 12873
effects of heavy metals on organisms, 13577
Galveston Bay, Texas, fish species diversity as pollution index, 13951
Gulf of St. Lawrence, fish of, bibliography, 14118
Mississippi-, lymphocystis in croaker and seatrout, 12885

Estuaries, cont.
new lake near Veere, Netherlands, fish fauna of, 14005
Pensacola, Fla., DDT residues in fishes, 13841
pesticide effects, 1969 research of BCF Station, Gulf Breeze, Fla., 13009
Placentia Bay, role of FRB of Canada in "red" herring phosphorus pollution crisis, 14059
ponds, sewage-enriched-, fish and crustacean population, 13954
report of BCF Laboratory, St. Petersburg, Fla., 1969, 12836
San Pablo and Suisun Bays, Calif., food habits of white sturgeon, 13896
sediments, suspended and deposited, re organisms, bibliography, 12925
Weweantic River-, Mass., insecticide residues in winter flounder, 13353

Farm Ponds,
nesting success of bluegill, Ohio pond, 12860
Oklahoma-, 2-, scale and body growth of centrarchids, 13064
paraquat, effect on bluegill, Colo., 13296

Fertilization,
and water hyacinths, effect on food organisms and sunfish production, 14180
fertilizers, organic, efficacy in Amur fish breeding ponds, 12907
for striped bass production, report of Georgia hatchery, 14181
molybdenum, influence on trout and fishing, Castle Lake, Calif., 13075
P and N re plankton and fish production in ponds, 13921
polymicrofertilizers re development and survival of eggs, larvae, 12911
pond-, re culture of 2 species of tilapia, 14107
sewage-enriched estuarine ponds: fish and crustacean populations, 13954
silicate added to milkfish ponds to increase benthic algae, 13920

Food Habits,
amur, white, stocked alone in ponds and with other species, 13960
analysis of food of fishes, rapid volumetric method, 13163
anchovy, northern, 12964
bass,
largemouth, first year-class in new Fla. impoundment, 14047
striped,
surf waters of Long Island, 13688
young-of-the-year, Canton Reservoir, Okla., 13286
bream, European, feeding by age and season, Tsimlyansk Reservoir, USSR, 13683
buffalo, bigmouth, in simulated fish-farming environment, 13066
carp,
grass,
criteria for studying feeding re weed control, 13962
reared with other carps, USSR, 13677
reared with grass carps, USSR, 13677
silver,
daily food consumption, digestion rate, 13147
reared with other carps, USSR, 13677
catfish, channel, in southern Great Plains reservoir, 14094
chub, creek-, summer, 13547
Coregonus clupeoides of Lake Bala, Wales, England, 14104
crappie, white, young, in Conowingo Reservoir, 13551
Dolly Varden, in fresh water on Amchitka Island, Alaska, 14202
drum, red, southeastern Louisiana, 13549
flatfishes, re morphology of alimentary tract and feeding behavior, 13998
food,
consumption, daily-, of young pikeperch and roach, fish farms of USSR, 13528
re,
growth and survival of percid larvae, 14126
salmonid movements in 2 Idaho streams, 14135
selectivity and gill rakers of mackerels, tunas, dolphins, 13808

Food Habits, cont.
grayling, European, of River Lugg, England, 13481
grunion larvae, effects of delayed initial feeding, 13811
herbivorous cyprinid, new, of Cape Fear River Basin, No. Carolina, 14073
herring, White Sea, transition to active feeding by larvae, juveniles, 12848
larvae of Black Sea fishes, survival re food supply, 13134
mackerel, jack, 13897
mayflies of St. Maries River, Idaho, 13813
menhaden, Atlantic, young re metamorphosis, 13983
minnow, silverjaw, in Kentucky stream, 12816
Opsariichthys unicirostris juveniles in Lake Biwa, Japan, 14196
peled in Lake Dolgoye, USSR, 13765
perch, European, in,
drawdown zone, Kuibyshev Reservoir, USSR, 13138
Rostherne Mere, England, 14074
pike, northern, in Rostherne Mere, England, 14074
planktivorous fishes, feeding and starvation re behavior under different illumination, 13024
pompano, juvenile, in Louisiana, 14142
predatory demersal fish in Hauraki Gulf, New Zealand, 13995
prey capture in largemouth bass, 14095
reconstruction of size of prey fishes from vertebral fragments, 13540
salmon,
Baltic, smolts in river and sea, 13021
chinook, juvenile, in central Columbia River, 13733
sockeye,
cultured-, satiation time, appetite, maximum food intake, 13621
fry, comparison with sticklebacks, Wood River lakes, Alaska, 13631
in Bristol Bay before upward migration, 12889
young-, marine microorganisms in food, 12867
salmonids, stream, salmonid eggs as food for, 14043
sculpins, stream, salmonid eggs as food for, 14043
selection of food by sardine and anchovy larvae, laboratory study, 13432
shad, food organism isolation from gut content by centrifuge, 13244
sole, flathead, in E. Sound Orcas Island, Wash., 12835
stomach capacity, method of estimating, 14155
sturgeon, white, in San Pablo and Suisun Bays, Calif., 13896
sunfishes, three-, and hybrids, in 3 Minn. lakes, 13199
thirty fishes of western Lake Superior, 13892
tilapia,
larvae, transition to active feeding, 13148
species in Lagos Lagoon, 13476
trout,
brook, Castle Lake, Calif., 13076
brown, re Crustacea in Norwegian mountain reservoirs, 13699
cutthroat, sea-run-, at Eva Lake, Alaska, 13550
lake-, alevins in Lake Heney, Quebec, 13377
rainbow,
Castle Lake, Calif., 13076
feeding re abundance of drifting invertebrates in stream, 13351
tuna,
bluefin, in western North Atlantic, 12793
skipjack, in Atlantic Ocean, 13984
yellowfin, in Atlantic Ocean, 13984
tyul'ka,Azov, food of larvae, feeding conditions re abundance, 13676
walleye, selective preference of 1959 year-class in Lake Erie, 14141

Genetics,
albinism in lampreys, upper Great Lakes, 13254
-analysis of recapture frequencies of released young Atlantic salmon, 13604
and mariculture, 13480

Genetics, cont.
char, Arctic, comparative electrophoresis of, 13785
chromosome,
breakage in humans from eating fish containing methylmercury, 13885
multiple-, sex-, in a Mexican killifish, 14157
numbers of some teleosts, 13051
preparation from fish blood leucocytes, 12993
somatic-, of southern brook lamprey, 13706
control in lakeward migrations of cutthroat fry, 13175
dehydrogenase, lactate- and malate-, isozyme patterns in fish, 13754
diploid male from a gynogenetic triploid of Poeciliopsis, 13564
DNA content, ribosomal gene multiplicity and cell size in fish, 14192
electrophoretic studies of,
blood sera, muscle extracts of catostomids, 12846
proteins of 4 species of tilapia, 13337
esterase isozymes of mummichog, developmental genetics, 12843
genes, LDH-, evolution in fish, 13812
H^3-DNA, bacterial-, uptake into fish embryos, 13704
hybrid,
between inconnu and humpback whitefish, Chatanika River, Alaska, 13571
natural-, of spiny sturgeon X kura sevryuga, 13670
success, intergeneric-, egg size factor, centrarchids, 13173
hybridization,
molecular-, of MDH isozymes in vivo and in vitro, 14050
of MDH isozymes in interspecific bass hybrids, 14057
salmon, sex-related parental influence on early development, 13340
inheritance of tissue specific LDH isozymes in interspecific bass hybrids, 14207
LDH,
and meristic differences in rainbow trout above and below waterfall, 12942
gene,
function in blind cavefish,et al., 13854
homology: E gene function in teleost nervous system, 12837
isozymes,
of fish, developmental genetics, 12849, 12874
photoregulation of expression of, in mummichog, 13777
retinal-, specific-, evolution in teleosts, 13517
lens protein polymorphisms in hatchery and natural brook trout populations, 14147
malate dehydrogenase,
isozymes, S- and M-, variation in mummichog, 12927
supernatant-, multiple forms in salmonids, 13453
phenotypes,
tetrazolium oxidase-, of salmonids, 14072
transferrin-, of Atlantic salmon, geographical variation in, 14021
polymorphism,
hemoglobin, in sea- and landlocked Atlantic salmon, 13151
lactate dehydrogenase, in rainbow trout liver, gills, 12829
of,
MDH and genetic structure of juvenile saury population, 13848
muscle protein in genus Tilapia, 13821
phosphoglucomutase-, in,
Pacific Ocean perch, 14213
sockeye salmon, 12823
serum transferrin-, in some scombroids, 12937
transferrin, in salmon, 12830, 13352
proteins, soluble-, in eye lens nuclei of scombrids, 14070
pugheadedness in vermilion snapper, Gulf of Mexico, 13573
reproduction isolation between 2 sympatric daces, Manitoba, 13334
selective,
and intensified breeding of carp in ponds, USSR, 13094
mechanisms and development of insecticide-resistant fish, 13366

Genetics, cont.
shiner, sand-, populations, re enzyme function, 13641
subunit structures and molecular basis of multiple hemoglobins of trout. 14212
sunfish, Texas-, golden-, green-, color mutation of green sunfish, 13971
trout, rainbow, 4 strains from Beardsley Reservoir, Calif., comparison, 13315
unisexual fishes, special adaptative problems associated with, 13959
variation in,
Atlantic eel, interpretations of phenotypic frequency differences, 13607
Rhode Island and Icelandic eel populations, 14215

Habitat Improvement,
aerator performance in natural streams, 13952
destratification,
artificial, re benthos distribution in El Capitan Reservoir, 13080
pneumatic-, of density layers, 13283
oxygenation possibilities for large polluted rivers, 14176
pipe, inclined-, passage of adult salmon and trout thru, 14138
reclamation of waters with piscicides, FAO review, 13130
reef, manmade-, ecology of, 13691
screens for diverting juvenile salmon from turbine intakes, 14137
spawning,
channel, Rocky Reach-, for chinook salmon, evaluation, 13638
grounds, artificial-, for sturgeon, 13132
spot treatment of aquatic vegetation, plastic barrier for, 13304
structures, artificial-, for attracting coastal pelagic fishes, 13181

Harvest,
angler,
catch, mark-recovery method for estimating, 14143
success, comparative, Lake Mead, 13976
bass, striped,
Atlantic states, 12871
California, party boat fishery, 1960-68, 13323
shift in sites in Chesapeake Bay, 13701
billfishes of central Pacific, 12914
California inland angling survey, 1969, 13597
century of fisheries in North America, 14018
Columbia River, Indian net fisheries, 12931
creel survey,
Oklahoma, re different types of fishing, 12862
reservoirs, recommended method of reporting, 13457
exploitation effects show bluegill dominance in mixed population, 14011
exploited fish populations, calculation of sustainable yield, 13388
fish catch and pollution information system, principle and operation of, 14027
fishery associations in United States, 1969-70, list, 13656
fishes of Danube River, 14114
Flatbrook River, N. J., trout studies, 14159
flounder, summer, tagging study in N. J. waters, 14163
gillnet selectivity re sockeye and pink salmon, Skeena River system, 14032
menhaden, Atlantic, resource and fishery analysis of decline, 13924
Michigan's 1970 sport fishery, Jan.-Apr., 13711
perch, Pacific Ocean-, 13290
techniques and intensity required, 13282
pike, northern, in Lake Dargin, Poland, 14002
response of brook trout populations, 13628
sailfish sport fishery, Kenya, 1958-68, 13259
salmon,
Atlantic,
commercial and sport, Miramichi River, Canada, 13619
third report of ICES/ICNAF joint working party, 14049

Harvest, cont.
salmon, cont.
by,
gillnet mesh restrictions to minimize steelhead catch, 13281
Washington troll fleet in 1967, 13280
coho,
1964-hatchery-, re size at release, 13060
size, age and maturity in Wash. troll fishery, 13285
Columbia River hatchery-, contribution to 1966 catch, 13056
IPSFC Annual Report – 1970, 14144
linear-programming solution to management, 13160
sockeye, in Alaska, 13816
salmonids,
in small mountain lake, Sweden, 13560
Michigan's 1969 sport fishery, 13091
seatrout, 18-year trawl captures, So. Carolina, 13360
smelt fishery in Lake Erie in early 1960's, 13101
sport,
fishery survey, Upper Mississippi River, 1967-68, 13844
fishing,
enterprises and fishing dock operators, Okla., 13055
seminar, Oct. 8-9, 1970, Myrtle Beach, S. C., 14075
"Sport Fishing USA", published by USDI, Bur. Sport Fisheries & Wildlife, 13769
sturgeon party boat fishery, 1964-69, Calif., 14084
survey, creel, 1969, of Illinois portion of Lake Michigan, 13065
swordfish, Canadian Atlantic, recent changes in size composition, 12866
trout, rainbow,
stocked in Great Lakes, 13565
4 strains from Beardsley Reservoir, Calif., 13315
tunas,
and marlins in Atlantic Ocean, 13389
tropical Atlantic fishery, mid-1950's to mid-1960's, 13038

Identification,
Brachiella lageniformis on hake in Canadian Pacific, taxonomic significance, 13336
burbot, morphological variation and recognition of subspecies, 13098
catostomids, electrophoresis of blood sera, muscle extracts, 12486
cave and spring fishes of southern bend of Tenn. River, 13910
char, Arctic,
comparative electrophoresis of, 13785
meristic differences, Sagavanirktok River, Alaska, 13129
morphology and variability of, Kamchatka River, USSR, 13462
checklist of fishes in Buttonwood Canal, Fla., 13257
clupeid larvae, differences, River Elbe, Germany, 13433
cobia, prejuvenile and juvenile, Gulf of Mexico, 13250
Dactylogyrus in North America, key, 12956
dehydrogenase, lactate- and malate-, isozyme patterns in fish, 13754
eel, Atlantic, genetic variation, interpretations of phenotypic frequency differences, 13607
Etheostoma barbouri, new data from Green River basin, 13248
fish of the Gulf of St. Lawrence, bibliography, 14118
flatfishes (Heterosomata) of New Zealand, guide, 12895
flounder, summer-, description of eggs, larvae, 12966
food organisms separated from shad foregut contents by centrifuge, 13244
formaldehyde in aquatic animals, by chromatography, 13217
freshwater fishes of northwestern Canada and Alaska, 13330
galaxiid fishes of New Zealand, 13617
Hirudinoidea, freshwater-, of Canada, key, 13871
key to eggs in early larval stages of Israeli mullets, 13824

Identification, cont.
mackerel larvae and juveniles in western North Atlantic, 13981
mercury, detection in fish killed by pollution, 13218
mullets, Black Sea, intraspecific differentiation of blood sera proteins, 13679
Nocomis of eastern U. S., 13992
Notropis,
gibbsi, new cyprinid from Tallapoosa River system, 13249
mekistocholas, new herbivorous cyprinid of Cape Fear River basin, 14073
perch, Pacific Ocean-, 13290
phenotypes,
tetrazolium oxidase-, of rainbow trout and Pacific salmon, 14072
transferrin-, of Atlantic salmon, geographical variation in, 14021
phylogeny re immunoglobins of giant grouper, 13242
Recent fishes, estimates of number of species, 13324
rockfish, channel, protein differences in eye lens cortex and nucleus, 13900
salmon,
Atlantic,
sea- and landlocked-, hemoglobin polymorphism, 13151
transferrin polymorphism, 12830
Caspian,
and brown trout, from 2 rivers of USSR, antigenic features, 13686
re protein composition of blood serum, 13140
coho, by transferrin polymorphism, 13352
morphology of juvenile chum- and pink-, 12891
sockeye,
chemoprints of stocks thru spectrometry and multivariate analysis, 13620
groups in Chignik River system, 13633
salmonids,
from different areas by X-ray spectrometry, 13489
of eastern Canada, muscle protein electrophoresis, 12952
scombrids, soluble proteins in eye lens nuclei of, 14070
scombroids, serum transferrin polymorphism, 12937
scorpaenids, northeastern Pacific, 13343
seaweeds and seagrasses near Port Aransas, Texas, guide, 13083
Sebastes variegatus, new scorpaenid from northeastern Pacific, 13810
Sebastodes, interspecific variation of tetrazolium oxidase, 12961
shiner, sand-, populations, re esterase functions and genetics, 13641
sturgeon,
Russian, races, 13669
Siberian, albumin composition of blood serum in 2 populations, 12982
teleost gonadotrope cells using methallibure and thiourea, 13634
Tilapia,
muscle protein polymorphism in genus, 13821
4 species, electrophoretic studies of proteins, 13337
trout,
brook, lens protein polymorphisms in hatchery and natural populations, 14147
Dolly Varden, validity of subspecies descriptions, No. America, 12929
lake, intraspecific variations, 13861
rainbow, LDH,
and meristic differences below and above waterfall, 12942
polymorphism in liver, gills, 12829
tunas, young, internal development, 13252
Vibrio anguillarum, re vibriosis in Pacific salmon cultured in Canada, 13868

In vitro,
cell lines, salmonid and mammalian, CO_2 requirements, 13289
conversion of DDT to DDD by gut microflora of anchovy, 12855
culture of,
goldfish cells at high temperatures, 13052
some teleost tissues re chromosome numbers, 13051

In vitro, cont.
effect of endrin on succinic dehydrogenase activity in resistant and susceptible mosquitofish, 13803
hybridization,
molecular, of MDH isozymes, 14050
of MDH isozymes in interspecific bass hybrids, 14057
steroidogenesis in,
testicular tissue of northern pike, 13405
yellow bodies from sturgeon, 13856

Lake,
Aleknagik, Alaska, distribution and growth of sockeye, fry, 1962, 13632
alpine and subalpine lakes, Canada, crustacean zooplankton, 13615
Arctic, small, Arctic char production, 13491
Aviemore, New Zealand, experimental winter angling for salmonids, 13953
Baikal,
age-related changes in grayling blood, 13143
feeding and starvation re behavior of planktivorous fishes under different illumination, 13024
Bala, Wales, England, food of Coregonus clupeoides, 14104
Benmore, New Zealand, experimental winter angling for salmonids, 13953
Biwa, Japan, food selectivity of juvenile Opsariichthys uncirostris, 14196
Black Pond, New York, effect of alewife predation on zooplankton, 13555
Canandaigua, New York, limnology, 13574
Carl Blackwell, Oklahoma, carp dynamics, 12852
Caspian Sea, Microsporidea of fishes of, 13746
Castle, California,
influence of molybdenum on trout and fishing, 13075
study of trout food, 13076
Champlain, distribution of larval trematodes, re fish hosts, 13689
Chew Valley-, decline of European roach population, 13488
Dal'neye, USSR,
analog model of ecosystem of, 13454
kidney in cation homeostasis in anadromous and other fishes, 13023
Dargin, fishing exploitation and catches of pike in, 14002
Dojran, Yugoslavia, acclimatization of Israeli carp, 14009
Dolgoye, USSR, food habits of peled, 13765
Echo-, Maine, seasonal depth distribution of salmonids, alewives, 11833
Erie,
eastern, typical fish mortality rates, 12924
selective food preference of 1959 year-class of walleyes, 14141
smelt distribution and fishery in early 1960's, 13101
eutrophic-, stream of energy in ecosystem of, 12811
Eva, Alaska, age, food and migration of sea-run cutthroat, 13550
experimental lakes studies, Canada,
initial survey, 13583
rationale, background and development, 13582
Francis Case, changes in fish populations, 1952-68, 13331
Great Lakes,
harvest, movement and growth of stocked rainbow trout, 13565
insecticide problem, particularly DDT re coho salmon, 13884
prospectus for sport fishery research, 12973
Pseudacolpenteron pavlovskii from Great Lakes carp, 13739
sea lamprey control, 12799
species interactions of alewife, 12798
upper,
albinism in lampreys, 13254
giant American brook lampreys, 13877
Heney, Quebec, capture, morphology and food of lake trout alevins, 13377
high-mountain-, Sweden, distribution of trout and char in, 13696

Lake, cont.
Idaho, 4 lakes, crustaceans and samplings in, 13014
Iliamna, egg development of sockeye re physical environment, 13636
Il'men, USSR, reconstruction of fish growth using bream, 13149
Jennings, Calif., introduction of blue catfish, 13319
Karluk-, Alaska, brown bear predation on sockeye salmon, 13796
Lac Allemands, La., survey of factors affecting fish production, 14189
Ladoga, USSR, spawning biology of pikeperch, 13524
Lambarfjarden, Sweden, spatial distribution of pelagic fishes, 13561
Lichen, food coefficient of young pikeperch from, 13999
Maine lakes, survival of stocked landlocked alewives, 13736
Mälaren, Sweden, Triaenophorus in fishes of, 13698
manmade, report of stock assessment group, Uganda, 12081
Matamek, sex ratio and fecundity of smelt, 12822
Mead, comparative angler success, 13976
Michigan,
alewife predation on zooplankton, effects, 13430
1969 creel survey of Illinois portion, 13065
DDT metabolized by microorganisms, 13815
fecundity of coho salmon, 13079
fin degeneration in young alewives, 13047
Mullet Pond, on barrier beach, No. Carolina, fishes and changes, 13749
Munsel, Oregon, evaluation of cutthroat stocking, 13179
Oneida, N. Y., parasites of yellow perch, 13735
Ontario, biology of Ergasilus confusus re yellow perch, 12824
Opeongo, Ontario, re mark - recovery method for estimating anglers' catch, 14143
reclamation by chemical method with polychlorpinene, 12953
reservoir,
Arizona reservoirs, central-, maturity and fecundity of threadfin shad, 13180
Beardsley, Calif., harvest of 4 strains of rainbow trout, 13315
Boomer-, Okla.,
benthic macroinvertebrates, 13039
power-plant heated water re benthos, 13063
Bratskoe, USSR, results of acclimatization of fishes, 13355
Brownlee,
distribution and movement of juvenile salmon, 1962-65, 13496
emigration of juvenile salmon and trout, 1963-65, 13497
migration of juvenile salmonids into, 1962-65, 13495
Canton, Okla.,
age and growth of walleye, 13292
distribution and abundance of zooplankton, 13264
fish population of stilling basin, 13314
fish samples and year-class strength, 1965-67, 13318
food habits of young striped bass, 13286
central Arizona reservoirs: age, growth and populations of threadfin shad, 12797
Conowingo, food habits of young white crappie, 13551
creel survey, recommended reporting method, 13457
Dnieper,
flow and pollution re food supply of benthic feeding fishes, 13145
planktobenthic crustaceans as fish food, 13761
El Capitan-, artificial destratification re distribution of bottom organisms, 13080
fishes, larval-, sampling gear for, 13978
fisheries management re power engineering, 13461
Francis Case, effect of plankton discharges from upper reservoir on crop in lower one, 13041
Hexagenia naiads in Oklahoma Reservoir, 13067
Hoover-, Ohio, age and growth of walleye, 13073

Lake, cont.
reservoir, cont.
hydroelectric, Norway, winter migration of char, 13559
in Oklahoma, endoparasitic helminths of catfish, crappie, 13040
in southern Great Plains, food of channel catfish in, 14094
invertebrates, evaluation of number and distribution, USSR, 12913
Kremenchug, USSR, metabolic rate in young commercial fishes, 13455
Kuibyshev, USSR,
age,
and size composition of carp spawners, 13536
-related changes of Cu and Zn in bream, 13026
feeding of perch in drawdown zone, 13138
percid spawning grounds, larvae and reproduction, 14124
Lewis and Clark, effect of plankton discharges from upper reservoir on crop in lower one, 13041
manipulation of waters for quality and fish response, 12980
Mingechaur, USSR, results of introduction of mysids, 13915
Norwegian mountain reservoirs, Lepidurus arcticus in brown trout diet, 13699
Ocklawaha, Fla., growth, condition and food habits of first-year-class of bass, 14047
Puddingstone, Calif., nighttime artificial aeration for suitable conditions for trout, 13887
Rybinsk, USSR,
condition and fatness of blue bream, 13137
seasonal distribution of landlocked smelt, 13532
Texas reservoirs, thermal requirements to protect life, 12877
Tsimlyansk, USSR,
changes in daily feeding of bream, by age and season, 13683
food resources and utilization by fishes, 13530
Uchinsk, USSR, annulus formation on scales of roach, 13675
USSR, invertebrates stocked as food source, 13838
weeding of, by use of herbivorous fish, 14055
Wheeler, Ala., life history of drum and buffalo, 14164
Wilson, Kansas, impoundment biology, 13358
Rostherne Mere, England, observations on fish populations, 14074
St. Clair, estimation of mercury in walleyes, 13558
Superior,
life history of rainbow trout in Batchawana Bay, 13942
population biology of lake trout before 1950, 13121
water quality and trophic condition, 13246
western, food habits of 30 fishes of, 13892
Tahoe, kokanee salmon production and life history, 13325
Texoma, vertical distribution of white crappie, 13291
Trapper's, Colo., size limit regulation re trout fishery, 13178
trout-, studies, Colo., ^{137}Cs data, 13189
Volta, Africa, schooling and migration of pelagic fishes, 14116
Washington, assessing juvenile sockeye stock by echo integration, 13188
Winnebago,
age and growth of white bass, 14153
reproduction and early life history of walleye, 12938
Wood River lakes, Alaska, food competition between sockeye fry and sticklebacks, 13631
Yellowstone, Wyo., parasites of cutthroat trout, 13511

Life History,
billfishes of central Pacific, re harvest, 12914
bream, European, acclimatized in upper Ob' River, USSR, 13521
buffalo, smallmouth, in Wheeler Reservoir, Ala., 14164
croaker, Atlantic, in Gulf of Mexico nursery areas, 14019
drum, freshwater, in Wheeler Reservoir, Ala., 14164
fishes, Buttonwood Canal, Fla., 13257

Life History, cont.
lamprey, Volga, below Volgograd Dam, and larval development, 13672
metamorphosis of the landlocked sea lamprey, 13096
mullet, grey, coordinated studies on, 14173
perch, Pacific Ocean, 13290
pikeperch, spawning biology of,Lake Ladoga, USSR, 13524
redfin, eastern, Sakhalin waters, 13671
salmon,
chum, acclimatized in Caspian Sea, 13682
sockeye, in Alaska, 13816
sculpin, shorthorn, in Newfoundland waters, 13335
shad, threadfin, maturity and fecundity in central Arizona reservoirs, 13180
shiner,
-perch, in upper Newport Bay, Calif., 13990
sand, in Smoky Hill River, Kansas, 13068
snappers (Fam. Lutjanidae) and their distribution, 14120
spot, in Gulf of Mexico nursery areas, 14019
sturgeon, lake-, 13552
trout,
brown, of Karelian Isthmus, 13463
rainbow, in Batchawana Bay, Lake Superior, 13942
walleye, young, of Lake Winnebago region, 12938

Limnology,
aquatic weed decay: O utilization and N and P regeneration, 14223
benthos, differences above and below impoundment, 13116
bottom soil properties in carp ponds re pollution with colliery wastes, 13728
Canandaigua Lake, N. Y., 13574
characterization of lakes by sediment diatoms, experimental lakes area, Canada, 13595
chemical characterization of experimental lakes, Canada, 13587
chemistry of surface sediments, experimental lakes studies, Canada, 13596
chlorophyll, surface-, as index of euphotic layer productivity, depth, chlorophyll, 13042
crustacean plankton, experimental lakes area, Canada, 13591
destratification, pneumatic-, of density layers, 13283
eutrophic lake, stream of energy in ecosystem of, 12811
eutrophication,
in large lakes and impoundments, 13602
rationale, background and development of experimental lakes studies, Canada, 13582
role of aquatic vascular plants, Mass. lakes, 13580
experimental lakes studies, hypothesis on similarities and differences among lakes, Canada, 13585
fish populations, differences above and below impoundments, 13117
geography, bathymetry, selected basins of experimental lakes area, Canada, 13584
impoundment of biology of Wilson Reservoir, Canada, 13358
light regime, experimental lakes, Canada, 13586
mercury in lake waters, determination of submicrogram quantities, 13203
methylmercury, pathways into fish, 13364
minor elements, survey in surface waters of U. S., 13581
oligotrophic pond, nutrient limiting factors, 13131
oxygen,
diel, prediction of minimum in ponds with macrophytes, 13299
regime, experimental lakes, Canada, 13586
periphyton, experimental lakes area, Canada, 13590
phosphorus dynamics in Chupei fish ponds, 13945
photosynthesis, liquid scintillation method for determining ^{14}C activity, 13588

Limnology, cont.
phytoplankton,
experimental lakes area, Canada, 13588
production, chemical factors in, experimental lakes, Canada, 13589
plankton discharges from upper reservoir re crop in lower one, 13041
primary production, experimental lakes area, Canada, 13588
quality, water-, re migration of fall salmon in Willanette River, 12977
strip mine pond in western Maryland, 13710
survey, initial-, experimental lakes area, Canada, 13583
temperature,
plotting bathythermograph data on computer printer, 13124
regime, experimental lakes, Canada, 13586
trout lakes studies, Colo., ^{137}Cs data, 13189
water quality and,
environmental factors, effect on fish, Rio Grande River, 13603
trophic condition of Lake Superior, 13246
winterkill survival and variability in yellow perch, 13426
zoobenthos, experimental lakes, Canada, 13594
zooplankton,
seasonal calorific values via modified calorimeter, 13874
vertical distribution and seasonal abundance, experimental lakes, Canada, 13592

Management,
Androscoggin River, N. H., recreational use of 13-Mile Woods section, 13886
BSF&W coordination between state highway- and fish and game departments, 13893
century of fisheries in No. America, 14018
cooling reservoirs, beneficial uses of heated water, 13424
Cooperative Fishery Unit Report for 1969-70, 13505
creel survey, Okla., re different types of fishing, 12862
destratification,
artificial, effects on depth distribution of zooplankton, 13567
pneumatic-, of density layers, 13283
federal aid activities, BCF, 12842
fish-guiding system, electrical-, water velocity re efficiency, 13498
fisheries-, in impoundments, re power engineering, 13461
fishery-,
and science, 14119
workers, inland-, of Europe, list, 14064
fishes in pest situations, 12876
herbivorous fish,
for weed control, 14056
in fish farming and weeding of reservoirs, 14055
introduction of mysids into reservoir in USSR as fish food, 13915
juvenile fish, diversion and collection with traveling screen, 13365
lamprey, sea, control in Great Lakes, 12799
mesh restrictions to minimize steelhead catch in gillnet salmon fishery, 13281
multivariate analysis for fishery biology, 13473
overwintering period of sturgeons in River Terek, USSR, 13837
pike, northern, populations, 12814
pupfish, Owens, in Mono County, Calif., 14145
reclamation of,
lakes by chemical method with polychlorpinene, 12963
waters with piscicides, FAO review, 13130
regulated lakes, effect on cestode populations of Swedish whitefish, 14178
reservoir,
manipulation of waters for quality and fish response, 12980
Puddingstone, Calif., nighttime artificial aeration for trout conditions, 13887
Review, 1969-70, FRB of Canada, 13882
rotenone, surfacing of dead fish after application, 12802

Management, cont.
salmon,
Atlantic,
Canada's new policy, 13563
Salmon Research Trust of Ireland, Inc., 13458
coho, size, age and maturity in Wash. troll fishery, 13285
IPSFC Annual Report - 1970, 14144
linear-programming solution to, 13160
shad, juvenile, electroshocker for collection at hydroelectric intakes, 13306
size limit,
changes, quick methods for estimating effect on catch, 12967
regulation, effect on trout fishery, Colo. lake, 13178
snail destruction with frescon for control of Diplostomum spathaceum, 14105
spawning channel, Rocky Reach-, for chinook salmon, evaluation, 13638
sport fishing seminar, Oct. 8-9, 1970, Myrtle Beach, S.C., 14075
"Sport Fishing USA", published by USDI, Bur. Sport Fish. & Wildlife, 13769
structures, artificial-, for attracting coastal pelagic fishes, 13181
sturgeon, lake-, 13552
survey and charting of fisheries resources, 14022
toxicity, utilizing and applying bioassay results, 13012
trout,
Flatbrook, N. J., studies, 14159
rainbow, comparison of 4 strains, Beardsley Reservoir, Calif., 13315
weed control by grass carp, criteria for studying feeding, 13962
winter angling, experimental, for salmonids in New Zealand lakes, 13953

Marking,
Dennison tagging of pink salmon, hematological effects, 13783
dyes, fluorescent-, injected into small fish, 13110
fin,
-clipping re survival and growth of smallmouth bass, 14139
-pulling as a technique for marking muskellunge fingerlings, 13515
gun, tagging-, for marking flatfish, 13443
jaw tagging, effects on growth and scales of landlocked salmon, 13870
staining technique, in situ, for hypothalamo-neurohypophysial study in eel, 12900
stains, biological, for small Atlantic herring, 13974
tag,
color-coded, paper-fastener-, used in evaluation of alewife fishway, 13667
nylon-thread-, shedding in marking experiment with trout, char, Sweden, 13695
transponding-, acoustic-, track with sonar, 13328
tagging effect on fatty acid metabolism in juvenile pink salmon, 14091
^{65}Zn for movement study and stock identity of coho in ocean, 13057

Mathematics,
analog of ecosystem of Lake Dalneye, 13454
analysis,
biostatistical-, of baitfish industry, Colo. River, 13084
of temperature and salinity effect on metabolism of tilapia, 14188
theoretical-, of effect of increased mortality of young brook trout, 14136
analytical method re susceptibility of fish to a pesticide, 13071
ATP-sensitivity of actomysin and myosin from carp muscle, formula definition, 13219
biostatistical method of A. N. Derzhavin, analysis, 13157, 13162
calculation of sustainable yield, exploited fish populations, 13388
computer program for ,
capture-recapture model of Jolly, 13623
processing catch data, 13876
creel census data, actual vs. reported fishing times as factor, 13311
curves,
recruitment-, comparison of two, 13912
reproduction-, effect of superimposed mortalities on, 13059

Mathematics, cont.
description of N excretion and protein consumption of bluegill, 13626
equation,
for relation between coefficient of inbreeding and expected recapture frequency, young Atlantic salmon, 13604
metabolic rate-, for pikeperch, perch, roach, carp-bream larvae, 12908
estimation of,
effect of size limit changes on catch, quick methods, 12967
fish stomach capactiy, 14155
fat content re wet and dry weight of fishes, Azov - Black Sea basin, 13150
fishery associations in United States, 1969-70, list, 13656
food conversion, effects of temperature on coefficients β', β, and γ, 13275
formula for,
change in toxicity of mercurials with growth of Oryzias latipes, 13232
efficiency of food conversion, 13212
use in breeding fishes, 13213
growth efficiency of fish,
in nature, prediction of, 14030
laboratory analysis, 14029
information system for fish catch and pollution, principle and operation of, 14027
kinetic model of fish toxicity threshold, 13907
linear-programming solution to salmon management, 13160
method for rating chemicals for potency against fish, 12969
model,
food-chain-, for DDT kinetics in marsh, 13263
simulation-, of lake trout growth, 14031
multivariate analysis for,
chemoprints of sockeye stocks, 13620
fishery biology, 13473
nomogram compilation re growth from scales, 12910
parameters of fish populations, evaluation based on catch and effort data, 13384
recruitment, dependence on parent stock in different groups of fishes, 14109

Migration and Movement,
albacore,
in Indian and Atlantic Oceans, 13383
on North Pacific longline grounds, 12838
alewife, evaluation of fishway, Gaspereau River, Canada, 13667
anadromous fish,
pheromones re orientation, 14042
thru locks, Cape Fear, N. C., spawning and nursery, 12933
bluefish, tagged in New York and southern New England waters, 12792
Chaoborus larvae, vertical re oxygen tension, 12859
char during winter in Norwegian hydroelectric reservoirs, 13559
determination with ^{65}Zn in oceanic coho, 13057
flounder, summer, tagging study in N. J. waters, 14163
herring, effect of light in Bay of Fundy, 13087
menhaden, Atlantic, juvenile, tagged in New England waters, 13707
patterns of some N. J. striped bass, 14158
pelagic fishes in new Volta Lake, Ghana, Africa, 14116
salmon,
adults thru inclined pipe, 14138
Atlantic,
changes,
in corpuscle of Stannius, 13403
Scottish river system, 13154
chum,
changes in corpuscle of Stannius, 13647
in Sea of Okhotsk, especially immatures, 13648
coho,
adult, renal function in, 13693
juvenile-, fall immigration into tributary, 13061

Migration and Movement, cont.
salmon, cont.
fall-, in lower Willamette River, re water quality, 12977
juvenile, in Brownlee Reservoir, 1962-65, 13496
kokanee, technique for enumerating fry migrating thru streams, 13876
masu,
and pink, biochemical differences during, 13017
re changes in testis, 12888
sockeye,
daily ration in Bristol Bay before up-migration, 12889
northeastern Pacific, 12785
young in White Sea rivers, 13135
salmonids,
fry from natal gravels to rearing areas, innate control, 14012
in 2 Idaho streams, re temperature, food, flow, cover, density, 14135
juvenile,
emigration from Brownlee Reservoir, 1963-65, 13497
gatewell orifices for bypassing dams, 13554
into Brownlee Reservoir, 1962-65, 13495
shrimp, ocean, vertical off Oregon, 13078
sole, petrale-, tagged in deep water off Washington coast, 13284
sticklebacks, prespawning-, effects of temperature on, 14038
trout,
cutthroat,
fry, lakeward, genetic control in, 13175
sea-run-, at Eva Lake, Alaska, 13550
Yellowstone Park creeks, 13176
rainbow, stocked in Great Lakes, 13565
tunas,
and marlins in Atlantic Ocean, 13389
in eastern Pacific, thru tagging, 14025

Oceanography,
Arabian Sea, reproduction of sea catfish, 13526
Caspian Sea, life history of chum salmon acclimatized in, 13682
distribution of salmon in North Pacific, and related features, 13853
Okhotsk Sea, distribution and migration of chum salmon especially immatures, 13648
physical and biological, near entrance to Gulf of California, 12897

Parasites,
Aplodiscus, proposed new genus, 13093
Apocreadium manteri, from spot, Gulf of Mexico, 13409
Aporocotyle macfarlani,
and Psettarium sebastodorum, habitat segregation re Pacific rockfishes, 14037
blood fluke of scorpaenid rockfishes, 13793
Argulus,
control with masoten treatment, 13851
occurrence in Scotland, 13493
Brachiella,
lageniformis on gills of hake in Canadian Pacific, 13336
robusta, parasitic on Pacific Ocean perch, 12941
Branchiomyces fungi re heavy mortalities of bleak in Italian lakes, 13947
Brooklynella hostilis, morphogenesis and cortical structure of, ciliate ectoparasite of marine fish, 14191
Caryophyllaeus fimbriceps, in carp and mullet in Iran, 13949
Ceratomyxa,
aggregata in halfbeak, 13187
shasta, in salmonids of northwestern U. S., 12806
cestode,
infestation, intestinal-, phenosal in feed for control, 13363
of Swedish whitefish, effect of lake regulation on, 14178

Parasites, cont.
Cestrahelmins rivularis from white sturgeon, Columbia River, 13737
Chondracanthus,
pinguis, parasitic on Pacific Ocean prrch, 12941
triventricosus sp. n., parasitic on Pacific Ocean perch, 12941
Clavella parva, parasitic on Pacific Ocean perch, 12941
Colobomatus kythosus sp. n., parasitic on Pacific Ocean perch, 12941
copper sulfate against, aquarium fishes, 13195
Cotylurus erraticus, migration of cercariae in rainbow trout, effects, 13794
crustaceans, planktonic-, on fish in Danube estuaries, 12916
Cystidicola, from salmonoids, review of Japanese species, 12902
Dactylogyrus,
carolinensis, from white shiner, N. C., 13751
in North America, 12956
24 new species, 13093
Diplostomum spathaceum, frescon for control of snail host of, 14105
Discocotyle sagittata, description of oncomiracidium, 13369
Echinorhynchus salmonis, Mysis and Pontoporeia as hosts, 13105
Ectenurus yamagutii from runner, jack and pinfish, Gulf of Mexico, 13557
ecto-, of fish, masoten for control, 13183
Eimeria carpelli, 13094
endohelminths, effects of season, host age and sex on, white sucker, 13417
Epistylis epizootics of fish in southeastern U. S., 12983
Ergasilus confusus, biology re yellow perch, Lake Ontario, 12824
fish parasitology, book, 13826
Fistulicola plicatus on Atlantic swordfish, 13115
Gastrocotyle indica, population dynamics of, on gills of Caranx kalla, 14211
Glaucivermis spinosus from southern kingfish of coastal Miss., 14222
Glugea luciopercae from pikeperch and Volga herring from Caspian Sea, 13746
Gyrodactylus,
asperus sp. n. from rough shiner, 12965
ictaluri sp. n. from channel catfish, 12965
lacustricolae sp. n. from lake chubsucker, 12965
lambanus sp. n. from longnose shiner, 12965
nataliae sp. n. from bigeye chub, 12965
trematoclithrus sp. n. from bluefin killifish, 12965
Haemogregarina cyprini in carp blood, pathology, 13690
Helicostoma, problem ciliate in marine fish farming, 14172
helminths,
endoparasitic-, of catfish and crappie in Okla. reservoir, 13040
of fishes from Forest River, N. D., 14099
of northern pike, Labrador, 13411
Heterophyes sp. in mullet flesh, effect of oxy- and chlortetracycline on, 13610
Hirudinoidea, freshwater-, of Canada, key, 13871
Ichthyophonus, fungus agent of epizootics in yellowtail flounder, 13438
Ichthyophthirius, control in circulating pond, 13005
Labrifer balli from pink seaperch, Calif., 13939
Lasiotocus trachinoti, from pompano, Fla., 13410
Lecithaster leiostomi, from spot, Gulf of Mexico, 13409
Lepocreadium sogandaresi from beaugregory, Gulf of Mexico, 13557
Lernaea,
control with masoten treatment, 13851
cyprinacea,
parasitosis in aquarium fish Lebistes reticulatus, 13661
transfer of larvae from goldfish to frog, 13418
Lernaeocera lusci, on wild sole under hatchery conditions, 12857
Ligula intestinalis, influence on body chemistry of bream, 14001
Metabronema, from salmonoids, review of Japanese species, 12902,
metazoan, of,
salmonids and coregonids, Newfoundland, 13111
2-spine stickleback in Newfoundland, 13202

Parasites, cont.
Myxidium,
sp. in ballyhoo, 13187
sphaericum in timucu, 13187
Myxosoma,
cephalis in striped mullet, 13187
cerebralis,
effect of freezing and aging on spores, 13508
re whirling disease in salmonids of U. S., 13663
Myzotrema cyclepti from gills of blue sucker, Ala., 13090
of,
centrarchids, impact of ecological succession in different lakes, 14112
cutthroat trout from Yellowstone Lake, Wyo., 13511
yellow perch in Oneida Lake, N. Y., 13735
Pellucidhaptor, new species, 12930, 13093
Plistophora,
ovariae, danger to golden shiner culture, 12841
siluri from European catfish of Caspian Sea, 13746
tuberifera sp. n. from Caspian gobies, 13746
Polyclithrum mugilini, new species from spriped mullet, 12936
Pomphorhynchus laevis, precipitin production by chub to, 13412
prophylactic measures in stocking new fishes in waters, 13381
Proteocephalus longicollis, inhibition of trypsin and α-amylase, 13441
Psettarium sebastodorum,
and Aporocotyle macfarlani, habitat segregation re Pacific rockfishes, 14037
blood fluke of scorpaenid rockfishes, 13793
Pseudacolpenteron pavlovskii from Great Lakes carps, 13739
Pseudomazocraeoides ontariensis n. sp. from gizzard shad, Bay of Quinte, Canada, 13766
Rhabdochona, from salmonoids, review of Japanese species, 12902
Saprolegnia, immune response of UDN-infected salmon, 12807
Sarcotaces arcticus, parasitic on Pacific Ocean percn, 12941
Schistocephalus,
effect of plerocercoids on respiration and behavior of Gasterosteus, 13655
solidus, balance of energy budget with stickleback host, 12809
Spirocamallanus pereraі from croaker, Texas, 13795
trematodes, larval-, in part of Lake Champlain, re fish hosts, 13689
Triaenophorus in fishes of Lake Malären, Sweden, 13698
trichodinid ciliates, from freshwater fishes, 12817
Tristoma,
coccineum on Atlantic swordfish, 13115
integrum on Atlantic swordfish, 13115
Trypanosoma catostomi n. sp. from white sucker, 14100
Urocleidus,
ammocryptus from darter, 12958
chlorosomus from darter, 12958
lottensis from darter, 12958
nigrofasciatus from darter, 12958
stigmaeus from darter, 12958

Physical Factors,
destratification, artificial, effects on depth distribution of zooplankton, 13567
flow,
regulation re fish fauna of lower Dnieper River, 13520
stream, re salmonid movements in 2 Idaho streams, 14135
heat,
and cold hardening experiments in fish, 13069
budget re circulation, Casco Bay, Maine, 13344
heated reservoir re body temperature of largemouth bass, 13726
illumination, different-, re influence of feeding and starvation on behavior of planktivorous fishes, 13024

Physical Factors, cont.
light,
effect on herring movements in Bay of Fundy, 13087
for attraction of food organisms, 12912
polarized, field evidence for sensitivity in Zenarchopterus, 13027
regime, experimental lakes, Canada, 13586
photoperiod, re,
fattening response to prolactin in killifish, 14081
growth, food consumption and conversion of channel catfish, 13579
prespawning behavior of sunfishes, 13261
re detoxification of antimycin, 13170
re sockeye egg development, Iliamna Lake beach areas, 13636
response of chinese carps to, 12975
temperature,
adaptation-, re enzyme activity changes in goldfish muscle, 13819
and,
environmental factors, effect on fish, Rio Grande River, 13603
salinity re development of flatfish and cod eggs, 13720
X-rays re mortality and growth of salmon embryos, 13545
changes, influence on,
ion and water content in tench blood plasma and tissues, 13031
muscle enzymes in,
bitterling, 13029
golden orfe, 13030
effect on,
digestion rate in fingerling sockeye, 13099
early development of Pacific cod, 14036
embryonic development of sole, 13934
growth,
efficiency of plaice prolarvae, 13956
form and hematology, chinook fingerlings, 13295
immune resistance of fish to pathogens, 13823
movement of prespawning sticklebacks, 14038
number of myomeres in grunion, 13049
effects of thermal increase on,
coldwater organisms, 13792
eggs and young of chinook salmon, 13644
influence on thyroid uptake of iodide by brook trout, 13732
low-, effect on physiology of tilapia, 13475
near-freezing-, re osmoregulation in freshwater fish, 14115
plotting bathythermograph data on computer printer, 13124
preferred by yearling lake trout, 13905
re,
activity of mullet sperm, 13482
culture of Dungeness crab larvae in laboratory, 13380
development of grunion, 13327
embryonic development of White Sea herring, 12870
growth,
and survival of percid larvae, 14126
food consumption and conversion of channel catfish, 13579
Hanford nuclear complex, effect on chinook reproduction, 12978
lactic and pyruvic acid changes during hypoxia, bluegill, 13322
nighttime artificial aeration of reservoir for trout conditions, 13887
prespawning behavior of sunfishes, 13261
responses of bullhead in gradual hypoxia, 13313
salmonid movements in 2 Idaho streams, 14135
specific activity of bluegill acetylcholinesterase, 12947
toxicity of ammonia to striped bass and stickleback, 13902
regime, experimental lakes, Canada, 13586
requirements for growth and survival of cisco larvae, 14039
selection response of guppies, effect of sodium pentobarbital, 14205

Physical Factors, cont.
temperature, cont.
sensitive neurons in brain of brook trout, 13451
stream-, effects of clear-cutting, 13011
subzero-, effects on serum osmolality in winter flounder, 13643
surface-, re distribution and abundance of skipjack in eastern Pacific, 14026
thermal,
pollution, resistance of rainbow trout to variations, 13401
relations in sockeye salmon, 13768
tolerance of,
albino vs. normal channel catfish, 12976
bloater, 12948
goldfish re superabundant oxygen, 12818
juvenile salmon re nitrogen supersaturation, 13193
some tropical Atlantic and Pacific fishes, 13727
velocity of water re efficiency of electrical fish-guiding system, 13498
water quality and trophic condition of Lake Superior, 13246

Physiology,
acclimation, thermal-, re variation of trout liver citrate synthases, 13449
accumulation and excretion of radioactive caesium by plaice and ray, 13814
acetylation in trout testis histone, 14168
acetylcholinesterase, temperature re specific activity, 12947
ACLE inhibition by parathion in fish, effect of sesamex on, 13781
actomyosin,
-ATPase activation by lecithin, 13234
preparation from carp muscle, 13216
superprecipitation from carp muscle, 13228
adaptation to salinity by different races of stickleback, 13820
adrenocortical tissue identification in sturgeon by histology and histochemistry, 13859
air contact, importance in life of rainbow trout, 13533
alkylpolyglycol ethers, effect on fish, 13192
α-tocopherol,
deficiency,
effects on carp, 13235
in carp, protein composition of dystrophic muscle, 13847
requirement of young carp, 13279
amino acids,
free, nutritive value, young carp, 13223
in brain and muscle of young Atlantic salmon, 14068
anaerobiosis, effect on cleavage and ATP of loach eggs, 12979
anemia, effect on ion exchange in southern flounder, 14093
anesthesia, quinaldine-MS-222 mixtures for trout and pike, 12992
anesthetization with MS-222, and handling, effects on brook trout, 13928
anti-dinitrophenyl antibody of gray snapper, 13413
antigenic,
features of Caspian salmon and brown trout of 2 rivers, USSR, 13686
specificity of blood groups that differentiate catfish populations, 13414
arginine requirement of chinook and coho salmon, 12850
aroclor 1254, uptake and retention in pinfish, spot, 13798
ascorbic acid, evidence for non-essentiality of, in rainbow trout diet, 13967
ATP,
activity re number of chloride cells in eel gills re sea-water adaptation, 13776
-sensitivity of actomyosin and myosin from carp muscle, 13219
ATPase,
activities of,
coho gills, alteration after ouabain injection and salt water adaptation, 13722
gills, re migration and salt water adaptation of coho, 12796
in coho gills, seasonal variations and salt water influence, 13112

Physiology, cont.
ATPases, fish-, sensitivity to PCB's, 14220
balance of energy budget re stickleback infested with parasite, 12809
biochemical,
adaptation to the environment, rainbow trout, 13771
differences in pink and masu salmon during migration, 13017
biological changes in capelin from overwintering to spawning condition, 13341
biotin requirement of carp, 13204
bladder,
gas, ion fluxes across, in normal and diamox-treated brook trout, 13782
urinary, control of water movement by prolactin, starry flounder, 13705
blind striped bass from Delaware River estuary, 12873
blood,
and tissue chemistry of brook trout after handling, MS-222, anesthesia and surgery, 13929
chemistry values for juvenile coho salmon, 13879
comparative study of 4 species of tilapia, 14210
component changes in mullet after injection of salmon hormones, 13779
of,
black, Baikal grayling, seasonal changes, 14131
rainbow trout, change when fed with sprat, 13748
body,
chemistry of bream, influence of Ligula intestinalis, 14001
temperature of largemouth bass in artificially heated reservoir, 13726
brain,
dynamics of MS-222 during anesthesia in freshwater fishes, 13034
rainbow trout-, effect of MS-222 on water- and electrolyte content, 13037
buoyancy adjustment in blacknose dace, 13102
C^{14},
cortisol injected into salmon, radioactivity changes re sexual maturation, 13394
incorporation in sturgeon eggs, young, 13020
^{14}C-DDT,
and ^{14}C-dieldrin, uptake, distribution and elimination in trout, 12790
transformation and accumulation in flatfish, 12917, 12918
Ca and Sr metabolism,
direct and intestinal absorption in growth conditions, 13629
EDTA re exchange from water, 13630
calcitonin of salmon, explanation for unusual potency, 14190
calcium content of chinook at stages of life cycle, 13153
carbohydrate in protein of rainbow trout egg, 13386
carbonic anhydrase in lactate secretion by swimbladder, 14089
carotenoids in,
Benibuna and goldfish, 13270
sea breams, 13265
cell lines, CO_2 requirements, salmonids and mammalian, 13289
chemical,
elements in tissue slices, detection and analysis with laser rays, 13608
languages of fishes, bullhead experiments, 13519
chemoreceptors, palatal-, in carp, effect of CO_2 on, 13753
chitinolytic activities in digestion of some fishes, 13271
chloralhydrate, effects as anesthetic on tilapia, 13255
chlorbutol, effects as anesthetic on tilapia, 13255
choline requirement of carp, 13757
cholinesterases, teleost-, histochemical specificity of, to phenylthioacetate in neural tissues, 13955
chromosome breakage in humans from consumption of fish containing methyl mercury, 13885
circulation time estimation in rainbow trout, 13103
circulatory system,
in eggs and larvae of some teleosts, 13044
parameters, trout, carp, eel, 13276

Physiology, cont.
cold death in killifish, chemical studies of, 14092
color change, effect of hypophysectomy, mummichog, 13236
cone cells, organization in retinae of teleosts, 13392
conversion/growth efficiency, re γ, β and β' values, 13752
corpuscle of Stannius, changes during,
migration and maturation, chum salmon, 13647
spawning migration, Atlantic salmon, 13403
cortisol secretion, effect of sexual maturity and gonadectomy on, sockeye, 13346
cortisone secretion, dynamics during sexual maturation and after gonadectomy, sockeye, 13347
^{137}Cs,
elimination in the mullet and blenny, 14041
residues in trout, Colorado lakes, 13189
Cu and Zn changes in Kuibyshev Reservoir bream, re age, 13026
cyprinid broodstocks held in lagoon fish farms, 13673
cytopathology and species specificity of sockeye virus in salmonid cell lines, 13382
DDT,
conversion to DDD by gut microflora of anchovy, 12855
DDE, and DDD uptake by fish, effects of salinity, 13371
residues in channel catfish in Nebraska, 13840
uptake from water by fish, effect of size, 13790
dehydrogenase, lactate- and malate-, isozyme patterns in fish, 13754
device for study of energy use and physiology of swimming in fishes, 13537
dieldrin,
concentrations in blood and brain of sunfish at death, 13880
residues in channel catfish in Nebraska, 13840
digestibility and metabolizable energy of fish feeds, method for measuring, 13963
digestion,
marine microorganisms in food of young salmon, 12867
rate,
in fingerling sockeye, temperature effect, 13099
re food consumption of silver carp, 13147
DNA content, ribosomal gene multiplicity and cell size in fish, 14192
effects of androgens, estrogens and cortisol on,
skin, stomach, liver, pancreas and kidney of gonadectomized sockeye, 13864
thyroid and pituitary of gonadectomized sockeye, 13863
egg,
size re size and age of female salmonids, 13525
weight and composition re size and age of Volga sturgeon, 14123
electric current, alternating-, effect on fishes and invertebrates, 13144
electrophoresis, comparative-, of Arctic char, 13785
endrin,
absorption by bluegill, 13472
effect on succinic dehydrogenase activity in resistant and susceptible mosquitofish, 13803
poisoning, chronic-, in goldfish, 13342
energy-metabolizing enzymes,
activity in kokanee salmon muscle, liver, 13649
changes in activity by spawning of kokanee salmon, 13651
enzymatic properties of plasma esterases from channel catfish, 13881
enzyme activity,
changes in goldfish muscle re adaptation temperature, 13819
re pH, temperature, water, whitefish and rainbow trout, 13439
enzymes,
fish-muscle, temperature effect in
bitterling, 13029
golden orfe, 13030
protease, amylase, arginase, GPT and GOT in cultured salmonids at different stages, 14184

Physiology, cont.
erythrocyte count and hematocrit of rainbow trout, 14201
erythrocytes of brown trout, D(+)-glucose permeability, 14103
esterase,
function and genetics of sand shiner populations, 13641
isozymes of mummichog, developmental genetics, 12843
esterases, Atlantic eel, genetic variation, interpretations of phenotypic frequency differences, 13607
evacuation rate of salmon alevins from whitefish stomach, 13126
exercise re changes in red and white muscle and liver in jack mackerel, 13809
expiration of water, opercular catheterization for sampling, 11831
fat,
content re wet and dry weight of fishes, Azov-Black Sea basin, 13150
cycles and condition factors of Altamaha River shads, 14013
fattening response to prolactin in killifish held on different photoperiods, 14081
fatness and condition of Arctic char from northern Sakhalin, 13022
fatty acid,
-amide in carp, sea bream, 13268
influence of pentachlorophenol on, coho, 13427
metabolism of juvenile pink salmon, effect of tagging, 14091
FDPase, properties from deep and shallow-water fishes, 13431
fecundity,
and gonads in brood carp and bream, Volga Delta, 13019
of,
Arctic grayling, 13294
Atlantic salmon from two Maine rivers, 13938
fall chinook salmon, upper Columbia River, 13639
regularities of change in, on example of sprats, 13391
feeding,
and digestion of a marine cottid and a freshwater one, 13486
and protein digestibility of silver carp, 13923
mechanics of, in various teleosts, 13374
fertilization of trout eggs, effect of copper, nickel, 13807
fish-, effects of pollutants on, 13576
food,
coefficient of young pikeperch from Lake Lichen, 13999
conversion, effects of temperature on coefficients β', β and γ, 13275
uptake and conversion efficiency, yellowtail, 13274
forebrainless tilapia, optomotor response of, 13712
formaldehyde, identification in aquatic animals by chromatography, 13217
gastric-, burbot as test subject for Basov's fistula, 13685
gill,
changes in rainbow trout under influence of malachite green, 14003
isolated-, perfused, of trout, effects of insecticides and MS-222 on, 13965
glands,
hatching, functioning in loach re oxygen, 11834
ultimobranchial-, and calcitonin in fishes, 14083
glucose (hexose 6-phosphate) dehydrogenase in liver of rainbow trout, 14218
glycolytic enzymes of muscle, changes in activity by spawning of kokanee salmon, 13651
glycoproteins as biological antifreeze agents in Antarctic fishes, 14177
gonad maturation and hormone-induced spawning, Gulf croaker, 13162
gonadal biopsy, evaluation from tag returns, striped bass, 13256
gonadotrope cells, teleosts-, identification using methallibure and thiourea, 13634
gonadotropin, salmon-, effect on spermatogenesis, vitellogenesis and ovulation of goldfish, 12864
gossypol diet, effects on rainbow trout, 12805
grayling, Baikal-, black-, young, 13456

Physiology, cont.
growth hormone re pituitary of sturgeon, paddlefish, 13415
H^3-DNA, bacterial-, uptake into fish embryos, 13704
heartbeat re respiratory movements in dogfish, 14087
heat and cold hardening experiments in fish, 13069
heavy metals, effects on marine and estuarine organisms, 13577
hematological effects of,
apholate on channel catfish, 13072
Dennison tagging on pink salmon, 13783
hematology,
chinook fingerlings, effect of temperature, 13295
of herbivorous carps of East Asia, 13435
hemoglobins,
Atlantic eel, genetic variation, interpretations of phenotypic frequency differences, 13607
monomorphism-polymorphism during microevolution of fishes, 12998
reactions with O_2 and CO re pH, carp, 13452
hemosiderin re erythropoiesis in blue gourami, 13118
histidine requirement of chinook and coho salmon, 12850
histochemistry of mucus on eel epidermis, 13209
histopathological changes in swimbladder disease of carp, 13946
homeostasis, cation-, role of kidney in anadromous and freshwater fishes, USSR, 13023
hyaluronidase, gastric-, mechanism of action in fish, 13221
hydroxysteroid dehydrogenases in mummichog testis, 13407
5-hydroxytryptamine in teleost pineal organs, 13408
hypophysectomy re survival of freshwater Atheriniformes, 12899
hypothalamo-neurohypophysial complex of eel, activity study, 12900
hypothalamus monoamines in, lampreys and ice-goby, 13210
hypoxia,
gradual, responses of bullhead at two temperatures, 13313
in sea raven, cardiac and respiratory responses, control mechanisms, 13865
lactic and pyruvic acid changes re temperature, bluegill, 13322
slowly- and rapidly-induced, response of dogfish, 14088
^{131}I, seasonal variation in accumulation and loss by catfish tissues, 13544
immune,
factors, humoral-, in paddlefish, 13786
macroglobulins, tetrameric-, in 3 orders of bony fishes, 13888
resistance of fish to pathogens, effect of temperature, 13823
immunization against furunculosis, antigenicity testing of vaccine, 13298
insecticides, interactions affecting residue storage in trout, 13378
"insulin-like" factor in pancreas of river lamprey, 13053
intestinal absorption of sugars in yearling carp, 13678
ionic regulation of the Arctic char, 13989
kidney,
relationship between Na resorption and Mg secretion, salmon, 12981
teleost-, coupling of Mg secretion and Na reabsorption, 12954
lactate acidosis as cause of mortality in captured sharks, 13267
lateral line system, development of sensory organs, ruff, 13043
LDH,
and meristic differences in rainbow trout below and above a waterfall, 12942
gene,
evolution in fish, 13812
function in blind cavefish, et al., 13854
homology; E gene function in teleost nervous system, 12837
isozymes,
of fish, developmental genetics, 12849
of teleost eye, brain, developmental genetics, 12874
photoregulation of expression of, in mummichog, 13777
polypeptides, directed assembly of, 12901
retinal-, specific-, evolution in teleosts, 13517
tissue-specific-, inheritance of, in interspecific bass hybrids, 14207

Physiology, cont.
LDH, cont.
polymorphism in rainbow trout liver, gills, 12829
lens protein polymorphisms in hatchery- and natural brook trout populations, 14147
leucocyte counts for normal Israeli mirror carp, 13662
leucocytes, circulating-, abundance,
and effect of cold shock and hypophysectomy on, in mummichog, 14193
and role of catecholamines in mummichog, 14194
role of adrenal cortex, leucocyte stress syndrome, mummichog, 14195
lipids,
endogenous, changes in diseased fishes, 13535
extraction from crude fish tissue, procedure, 13680
in eggs, young and spawning females in spring and autumn Baltic herring, 14125
liver,
cells, sexual differences in goldfish, 13645
composition of mature lampreys, 14203
protein-deficiency urocanase, carp, 13272
teleost-, coupling of Mg secretion and Na reabsorption, 12954
magnesium content of chinook at stages of life cycle, 13153
magnification and degradation of DDT and aldrin by invertebrates, 13933
malate dehydrogenase, supernatant-, multiple forms in salmonids, 13453
maturation,
and fecundity of threadfin shad in central Arizona reservoirs, 13180
and gametogenesis in male whitefish, USSR, 13018
fecundity and sex ratio of masu salmon at sea, 14197
of female pikeperch, effect of pituitary injections, 14121
of skipjack in western Pacific, 13986
MDH isozymes,
in vivo and in vitro hybridization of, 14050
S- and M-, variation in mummichog, 12927
melanophore responses,
in teleosts, continuous recording, 13375
of intact and eyeless black bullheads, 14090
reflectance method for measurement, 13370
melatonin,
demonstration and function in chinook, 13404
re body color and swimming in rainbow trout, 12959
mercury,
and methylmercuric-salt residues in lake trout re age, 13767
detection in fish killed by pollution, 13218
determination in,
fish by,
atomic absorption, 13605
neutron activation analysis, 13721
food and fluids by atomic absorption, 13609
estimation in Lake St. Clair walleyes, 13558
retention by salmon, 12988
metabolic,
aspects of sekoke disease (diabetes) in cultured carp, 13846
rate in,
larvae of pikeperch, perch, roach, carp-bream larvae, 12908
young fishes, Kremenchug Reservoir, USSR, 13455
metabolism,
active-, and standard-, and scope for activity, influencing factors in rainbow trout, 13878
calcium-, and maturation in mummichog, effects of darkness and vitamin C, 14079
iodide and thyroxine, in brook trout during exercise, 14066

Physiology, cont.
metabolism, cont.
nitrogen- and fat-, re growth of rainbow trout, 12960
of,
^{14}C-histamine in yellow eel, 13775
excised gill tissue re body size of sunfishes, 13654
pyruvate,
and especially nitrophenols in fish testes, 13085
by cod ovarian tissue, 13089
quinaldine by nurse sharks, 14046
sturgeons in early life stages, 13139
tilapia, mathematical analysis of temperature and salinity effect, 14188
oxygen- and phosphate-, of bluegill liver mitochondria, effects of cadmium, zinc, manganese and calcium, 13791
protein-, influence of feeding and body weight on, in bluegill, 14113
triose phosphate-, in developing loach embryo, 12943
methemoglobin in fish blood, 13538
methylmercury, determination in fish, 14020
MS-222, effects as anesthetic on tilapia, 13255
mucosa, intestinal-, alkaline phosphatase from, in eel, 13046
multiple hemoglobins of rainbow and cutthroat trout, structure and basis of, 14212
muscle,
composition of mature lampreys, 14203
determination of nucleotides, 13229
lateral, adrenergic blocking agents re adrenalin activity, rainbow trout, 13740
protein,
electrophoresis, Salmo of eastern Canada, 12952
polymorphism in genus Tilapia, 13821
TMAO, TMA and DMA content, 13231
white, post-mortem changes in sucker, pike, 12944
myosin, preparation from carp muscle, 13214
Na+/K+-ATP activity and Na transport in goldfish intestine, changes re temperature, 14085
nerves,
lateral-line-, effect of DDT on activity, rainbow trout, 13773
trypsin modification of Sihler staining technique for systematic studies of fishes, 14082
neurohypophysial hormones, isolation and amino-acid sequence, chinook, 13416
neurons, temperature-sensitive-, in brain of brook trout, 13451
nitrogen excretion and protein consumption of bluegill, 13626
non-protein nitrogenous constituents of eel muscle, change with shift from fresh- to sea water, 13787
nucleic acids, extraction from fish muscle and liver with phenol, 13208
5'-nucleotidase of immature sockeye testes, 12945
ocular oxygen concentrations in severe chronic ophthalmic pathology in lake trout, 13742
oils and,
fats of fish, properties, 13440
lipids, composition and biochemistry of, from marine and freshwater fishes, 13444
olfactory epithelium, electrical responses of, in Atlantic salmon, 13875
oogenesis and fecundity in Japanese horsemackerel, 14122
osmoregulation,
and endocrine glands of teleosts, 13278
disrupted by DDT in intestine of seawater eel, 14062
in freshwater fish at near-freezing temperatures, 14115
re histology of branchial epithelium in early chum salmon growth, 12847
osmoregulatory capability of juvenile sockeye salmon, 14204
ovaries of sockeye, caloric values at last stage of marine life, 13755

Physiology, cont.
oxygen,
consumption,
and swimming efficiency of goldfish, 13738
by bluegills exposed to copper, 14017
comparison of two respirometers for measuring, 14004
in ammocoetes of mountain brook lamprey, 12819
of rainbow trout, influence of activity and salinity, 14209
dissociation characteristics of rainbow trout blood, 13784
equilibria of hemoglobin in Cichlasoma cyanoguttatum, effects of ATP, et al., 13788
uptake and transport by rainbow trout exposed to CO, 13240
pancreas, ultrastructure of islets in diabetic carp, 13258
pars intermedia, inhibitory control of function and recovery after denervation, black bullhead, 13703
pathology of,
fish fed aflatoxins and other antimetabolites, 13988
Haemogregarina cyprini in carp blood, 13690
pentachlorophenol, determination in organic tissues and water, 13399
pepsin, bonito-,
enzymic properties of, 13759
purification of, 13758
peptides in brain of fishes, 13764
permeability to water of plains killifish, effects of prolactin and divalent ions, 13448
phenylmercuric hydroxide, effects of brief exposure in European roach, 13185
pheromones re orientation of anadromous fishes, 14042
phosphofruktokinase properties in muscle of goldfish under cold and warmth, 14071
phosphoglutomutase polymorphism in,
Pacific Ocean perch, 14213
sockeye salmon, 12823
phosphorus uptake from water by tilapia, 13165
pikeperch females, and biochemistry, Don River, USSR, 13467
pituitary,
basophile cells in hermaphrodite teleost during sexual cycle, 14185
gland,
changes of prolactin cells during life cycle, chum salmon, 13646
of goby re reproductive cycle, 13133
seasonal variation in protein content, 13570
potassium content of chinook at stages of life cycle, 13153
precipitin production by chub to Pomphorhynchus laevis, 13412
prolactin study in eel and salmon pituitary by immunofluorescence, 14224
propoxate, effects as anesthetic on tilapia, 13255
propylene phenoxetol, effects as anesthetic on tilapia, 13255
protein,
dietary-, utilization by young carp, 13220
differences in eye lens cortex and nucleus of channel rockfish, 13900
electrophoretic studies in 4 species of Tilapia, 13337
extracts from fish muscle, elution patterns, Japanese fishes, 13224
utilization re starvation in bluegill, 13171
proteins,
soluble, in eye lens nuclei of scombrids, 14070
vitamin B_{12}-binding-, of holostian fish, 13780
white-muscle-, maps and amino acid residues of, carp, cod, tilapia, 13045
proximate composition of grass carp, Puntius and tilapia, 14199
quinaldine,
effects as anesthetic on tilapia, 13255
influence of pH on efficacy and residues in bass, 14149
radiothyroxine, biliary excretion by brook trout, 13429
ration, daily-, sockeye in Bristol Bay before up-migration, 12889

Physiology, cont.
reactions of young salmonids to sudden changes in pH, CO_2 and D. O., 13697
red blood cell osmotic fragility in Spanish mackerel, 14217
reflecting spheres in eyes of weakfishes, 14221
reflectors, nitrogenous-compound-, in fishes, 13332
renal function in migrating adult coho salmon, 13693
residues,
DDT,
DDE and DDD in Saskatchewan River fish, re blackfly control, 13125
in Canadian Atlantic fishes, 13120
MS-222, sampling fish muscle for, 13128
quinaldine, sampling fish muscle for, 13128
respiration,
assay of minimum kraft effluents affecting, 13013
chamber for fish, continuously monitored, 13873
Clarias lazera, survivability without air breathing, 13239
considered from arterio-venous oxygen difference, 13233
gas exchange and water flow at gills of rainbow trout, 13241
of cardinal fishes, circadian rhythms, 14216
of Gasterosteus, effect of Schistocephalus plerocercoids, 13655
of young white bass, effects of swimming and food intake, 14148
respiratory,
movements, electrode chamber for recording, 13172
pumps, response to hypoxia in rainbow trout, 13446
responses of mummichog to cadmium, 13338
RNA,
-DNA ratios as indicators of recent growth rates of a fish, 13349
high polymer-, synthesis in loach embryo, 12906
scale, growing-, of rainbow trout, histochemical and structural aspects, 13708
sensitivity to polarized light in Zenarchopterus, 13027
serology,
albumen composition of blood serum in 2 populations of Siberian sturgeon, 12982
antibodies in serum from rainbow trout infected with Egtved virus, 14035
blood,
amino acid changes due to starvation, 13141
changes in brook trout exposed to copper, 13109
dynamics of MS-222 during anesthesia in freshwater fishes, 13034
of Baikal grayling, age-related changes, 13143
plasma and tissues of tench, temperature variations re ion and water content, 13031
serum,
amino acids in rainbow trout re DDT and dieldrin, 13778
and muscle extracts of catostomids, electrophoresis, 12846
characteristics, of spawning paddlefish, 13687
cod-, egg proteins in, natural and induced, 13800
osmolality,
in winter flounder, effects of subzero temperatures and trawling stress, 13643
sodium and chloride ion changes in tilapia re low temperature, 13475
protein changes with UDN in brown trout, 13484
proteins,
composition and fat in whitefishes, seasonal changes, 14130
in blood of Black Sea mullets, intraspecific differentiation, 13679
of cod re sexual ripeness and season, 13531
blue-green pigment of eel, lipid moiety, 13277
cortisol dynamics re maturation of sockeye salmon, 12869
hemoglobin,
fractions of cartilaginous ganoids, 12853
polymorphism in sea- and landlocked Atlantic salmon, 13151
1α-hydroxycorticosterone and testosterone in skate body fluids, 12883

Physiology, cont.
serology, cont.
immune response of UDN-infected salmon to Saprolegnia, 12807
immunoglobulins of giant grouper, phylogeny, 13242
lipids, blood serum-, comparison in White Sea fishes, 12974
N-ammonia and N-urea in healthy and ammonia-intoxicated carp, 13906
osmotic pressure changes, serum protein pattern,
rockfish, 13226
yellowtail, 13227
plasma,
adrenocorticosteroid levels in mummichog after hypophysectomy and fin-clip, 14080
cortisol, transcortin binding, in Atlantic salmon, 13088
protein composition of blood serum of Caspian salmon, re taxonomy, 13140
proteins, plasma-, binding of testosterone, cortisol, and 1-α-hydroxy-corticosterone, 12861
serum,
antibodies, effects of storage, goldfish, 13308
electrolyte regulation in mummichog re corpuscles of Stannius, 14078
glucose, osmoregulatory role in mummichog at near-freezing, 13166
protein studies of four tilapia by electrophoresis, 14187
transferrin,
phenotypes of Atlantic salmon, geographical variation in, 14021
polymorphism in some scombroids, 12937
SHBP,
binding of steroids by serum of thorny skate, 12903
isolation from thorny skate serum, 12904
transferrin polymorphism in Atlantic salmon, 12830
sexual maturity,
of shorthorn sculpin in Newfoundland waters, 13335
re body size composition of Japanese mackerel, 14182
SGOT of mollie, effects of dieldrin on, 13106
skeletal muscle fibers of gadids, effect of starvation and exercise on, 14219
sodium content of chinook at stages of life cycle, 13153
sperm,
rainbow trout- and peled-, effect of nitrosomethyl urea and dimethyl sulfate, 13035
viability of darter, effect of paternal death, 12995
spermatogenesis in salmonids, biosynthesis of protamine, 13114
spermiation of goldfish as bioassay for salmon gonadotropin, 13396
spermatozoa of,
cod, $^{14}CO_2$ fixation by, 13113
grey mullet, environmental factors influencing activity, 13482
starvation, changes in amino acid composition of muscle, blood, 13141
steroidogenesis in,
post- and pre-spawned ovaries of tilapia, 13774
testes of northern pike, 13405
-vitro-, in yellow bodies from sturgeon, 13856
sturgeon, young, reared on different feeds, 13743
surface-active agents, effects on marine animals, 14214
swimbladder,
development and function in haddock, 14097
permeability of, eel, 13741
swimming speed,
re tail beat frequency, amplitude and size in jack mackerel, et al., 13804
sustained-, in jack mackerel, 13805
taste responses in Atlantic salmon parr, 12940
teleost eggs, acrylamide gel as an embedding material, 14096
temperature,
brain- and muscle-, in oceanic and captive tuna, 13152
selection response of guppies, effect of sodium pentobarbital, 14205

Physiology, cont.
testes,
cells, trout, methionine incorporation at N-terminus of protamine, 13028
changes during migration of masu salmon, 12888
guppy, sterilization by parathion, 13402
histological change of, in precocious masu salmon parr, 13987
protamines and synthesis during development, trout, 13243
salmon-, de novo biosynthesis of inosinic and uridylic acids, 12865
tetrazolium oxidase,
interspecific variation in Sebastodes, 12961
phenotypes of salmonids, 14072
thermal,
relations in sockeye salmon, 13768
stress response re size of pinfish, 14200
tolerance of goldfish re superabundant oxygen, 12818
thiaminase occurrence in fish of United States and Canada, 14111
thiamine,
and thiaminase activity in silver carp liver and intestine, effect of food on, 13763
deficiency symptoms in eel, 13273
thyroid,
activity of white perch re temperature tolerance, 13167
uptake of iodide in brook trout, temperature influence, 13732
thyroxine, effect on swimming of cod, 13348
tissue, fish-,
freshwater-, ultrasonic properties, 12863
identification of MS-222 residues by chromatography, 13036
tolerance to fresh water of adult chum salmon reared in saltwater pond, 13611
toxaphene in fish, analysis by gas chromatography, 13400
transferrins,
Atlantic eel, genetic variation, interpretations of phenotypic frequency differences, 13607
polymorphism in coho salmon, 13352
trypsin and α-amylase inhibition by Proteocephalus longicollis, 13441
uptake and distribution of ^{14}C-dieldrin fed to goldfish, 13543
urethane, as anesthetic on tilapia, 13255
uricolytic enzymes in cod sperm, 13393
urophysial substance, effect on rainbow trout urinary bladder, 13406
ventilation, ram-, of fish gills, skipjack tuna, 11832
viability and growth of young carp re variation of spawning time, 13825
vitamin B_{12} production by microbes in carp intestine, 13225
warm-bodied fishes – tunas and lamnid sharks, 13770
yolk absorption and liver translocation in chum salmon development, 13833
zinc,
-65, concentration by eggs of Black Sea turbot, 14127
content in ripe sex products of carp, 13762
in carp during early development, 13606

Plankton,
algae, benthic, procedure for primary production study, 12909
Canandaigua Lake, N. Y., re alewife predation, 13574
copepod-, lights for attraction as food organisms, USSR, 12912
crustaceans,
as fish food, Dnieper Reservoir, 13761
experimental lakes, Canada, 13591
in alpine and subalpine lakes, Canada, 13615
parasitic to fish in Danube estuaries, 12916
sampling in four Idaho lakes, 13014
diatoms, algae, in upper Potomac River, re power-plant discharge, 13288
-discharges from upper reservoir re crop in lower reservoir, Missouri River, 13041

Plankton, cont.
effects of dichlobenil on, in pond, 14054
macro-, improved sampling methods and nets, 12856
macrozoo-, and small nekton off Vancouver Island and Wash., 1963, 13333
Peridinium polonicum, dinoflagellate producing ichthyotoxin glenodinine, 12923
pesticide effects on, Chew Valley Lake, England, 14165
phyto-,
chemical factors in production, experimental lakes, Canada, 13589
experimental lakes area, Canada, 13588
production in freshwater reservoirs, 12915
re P and N in fish culture ponds, 13921
sampler, quantitative-, 14175
sizing apparatus, opto-electronic-, 13490
toxicity of heptachlor, 12879
zoo-,
artificial destratification re depth distribution, 13567
distribution and abundance, Canton Reservoir, Okla., 13264
effects of alewife predation,
in ten Adirondack lakes, 13555
Lake Michigan, 13430
production with prolonged reproduction, 12826
seasonal calorific values via modified calorimeter, 13874
vertical distribution and seasonal abundance, experimental lakes, Canada, 13592

Pollution,
ABS,
and LAS, comparative effects on mosquitofish, 13502
effects on breeding behavior of Fla. flagfish, 14045
aldrin, magnification and degradation by invertebrates, 13933
alkylpolyglycol ethers, effect on fish, 13192
and fish catch information system, principle and operation of, 14027
aroclor 1254,
chronic toxicity, uptake and retention in pinfish and spot, 13798
in Escambia Bay, Fla., 12894
avoidance reactions of fish, 13376
bioassays to determine allowable waste concentrations in waters, 13575
BOD production of channel catfish, 12989
cadmium,
effect on oxygen and phosphate metabolism of bluegill liver mitochondria, 13791
physiological responses of mummichog, 13338
calcium, effect on oxygen and phosphate metabolism of bluegill liver mitochondria, 13791
carbaryl, toxicity to four salmonids, 13799
chlorinated hydrocarbons,
exchange equilibria control biological magnification in lentic environment, 13542
in marine ecosystems, 13419
residues in fish, Calif. estuaries, 12921
colliery wastes re soil properties in carp pond, 13728
control in chemical industry, application of ecological information for, 13996
copper,
effect on fertilization of rainbow trout, 13807
long-term exposure re survival, growth, reproduction of brook trout, 13931
solutions, bioassay against salmon eggs, fry, 13077
^{137}Cs, Colorado trout lake studies, 13189
DDD residues in St. Lawrence River ecosystem after application, 12812
DDT,
DDE, DDD, effects of salinity on uptake by fish, 13371
delayed mortality of Atlantic salmon after forest spraying, 13817

Pollution, cont.
DDT, cont.
effects of forest spraying on Atlantic salmon, 13822
food chain model for kinetics in freshwater marsh, 13263
in winter flounder, Weweantic River estuary, Mass., 13353
magnification and degradation by invertebrates, 13933
metabolized by microorganisms from Lake Michigan, 13815
possible mortality from, in young rainbow trout, 13994
re disrupted osmoregulation in eel intestine, 14062
residues in,
channel catfish in Nebraska, 13840
estuarine fauna, significance, 13421
fishes of estuary near Pensacola, Fla., 13841
toxicity to,
five semi-tropical fishes, 13501
four salmonids, 13799
uptake from water by fish, effect of size, 13790
de-inking wastes containing detergents, toxicity and treatment of, 13891
Delaware River, re status of striped bass in, 14067
detergents, inhibition of enzyme activity in rainbow trout, whitefish, 13439
dichlobenil, effects on pond factors, 14054
dieldrin,
effects on SGOT in mollie, 13106
in winter flounder, Weweantic River estuary, Mass., 13353
residues in channel catfish in Nebraska, 13840
toxicity to five semi-tropical fishes, 13501
effluents,
Hanford-, Columbia River, experimental drifts of juvenile salmonids thru, 13666
toxicity to fish, standard test, 12858
endrin,
absorption by bluegill, 13472
lesions in chronically exposed cutthroat trout, 13980
toxicity to four salmonids, 13799
English rivers, water quality and absence of fish, 13397
eutrophication in,
large lakes and impoundments, 13602
U. S. lakes, ecological response to human activities, 14161
fish,
kills, 1969, United States, 13186
species diversity as indicator of, in Galveston Bay, Texas, 13951
heated,
reservoir re body temperature of largemouth bass, 13726
water from power plant re benthos, Boomer Lake, Okla., 13063
heavy metals,
contamination of Canadian freshwater fish, survey, 13943
effects on marine and estuarine organisms, 13577
heptachlor in winter flounder, Weweantic River estuary, Mass., 13353
herbicides,
effects on water and inhabitants, 13368
selected-, toxicity to bluegill, 13070
toxic threshold values of, and toxicity to fish of substances in water, 14052
toxicity to certain freshwater crustacea, 14053
H_2S, toxicity to eggs and juvenile fish, 13499
industrial,
re food supply of benthic-feeding fishes, Dnieper Reservoir, 13145
spills, effect on stream organisms, 13692
insecticide-resistant fish, possible selective mechanisms in development, 13366
insecticides,
chlorinated hydrocarbon-, in fishes of southern Arizona, 13843
problem in Great Lakes, particularly DDT in coho, 13884

Pollution, cont.
iron-55 concentrations in commercial fishes of North Atlantic, 13033
kraft effluent,
assay of minimum affecting fish respiration, 13013
toxicity to Atlantic salmon, 12868
LAS,
and ABS, comparative effects on mosquitofish, 13502
factors affecting toxicity to bluegill, 13169
re toxicity of pesticides to fathead minnow, 13372
lindane, toxicity to five semi-tropical fishes, 13501
malathion,
chronic toxicity to bluegill, 13398
toxicity to four salmonids, 13799
manganese, effect on oxygen and phosphate metabolism of bluegill liver mitochondria, 13791
marine,
detection, measurement and monitoring of pollutants, UN report, 14086
report of,
FAO conference, re effects on living resources and fishing, 13908
third session of UN experts on scientific aspects, 14069
mercury,
and methylmercuric-salt residues in lake trout re age, 13767
compounds, conversion to methylmercury in nature, 13422
contamination of environment in Sweden, 13423
detection in fish killed by pollution, 13218
determination,
in fish by,
atomic absorption, 13605
neutron activation analysis, 13721
of submicrogram quantities in lake water, 13203
in,
fish,
and water from Norwegian river and fjord, 14208
hazards to humans, 13614
Sweden, re aquatic habitat, 13578
the environment, 13518
retention by salmon, 12988
syringe procedure for transfer of nanogram quantities of mercury vapor for analysis, 13857
wastes, satisfactory disposal of, from underwater laboratories, 14065
methoxychlor, acute toxicity to fish and breakdown studies, 13725
methylmercuy,
chromosome breakage in humans from fish consumption, 13885
determination in fish, 14020
pathways into fish, 13364
metoxyethylmercuric chloride, toxicity to Oryzias latipes, 13232
nickel, effect on fertilization of rainbow trout, 13807
nitrilotriacetate, acute toxicity to fry and crustaceans, 13442
NTA as anti-pollutant protecting fish from copper, zinc, 12875
nuclear reactor coolants, two-, organic-, fish toxicity, 12886
oil from,
coke ovens, fish kill, 13802
foundered tanker, effects on fish and invertebrates near Wake Island, 14048
organics, trace-, toxic effects on fish, 13205
organochlorine insecticides in trout of 3 New Zealand lakes, 13428
oxygenation possibilities for large rivers, 14176
parathion, sterilization of guppy testes, 13402
PCB's, sensitivity of fish ATPases to, 14220
pentachlorophenol determination in organic tissues and water, 13399

Pollution, cont.
pesticides,
effects on biota of Chew Valley Lake, England, 14165
model ecosystem for rating biodegradability and magnification, 14008
persistent-, in environment, review, 13997
phenol,
inhibition of enzyme activity in rainbow trout, whitefish, 13439
toxicity to five semi-tropical fishes, 13501
phenylmercuric,
acetate, toxicity to Oryzias latipes, 13232
hydroxide, effects of short exposure of European roach, 13185
phosphamidon, effects of forest spraying on Atlantic salmon, 13822
phosphorus, "red" herring-, role of FRB of Canada in crisis, 14059
poisons, toxicity to five semi-tropical fishes, 13501
pollutants,
avoidance reactions of salmonids, 12972
effects on physiology and behavior, 13576
toxicity, measurement of; chronic effects and "safe" concentrations, 14015
polychlorcamphene, consequences of entry into fishery waters, 13914
polychlorinated biphenyls, solubilized by surfactants for toxicity studies, 13390
potential of salmonid hatcheries, 13470
power-plant discharge, upper Potomac River, re diatoms and algae, 13288
pulp mill sulfides, re toxicity to and distribution of salmon, Wash., 12880
radioecology, estuarine, bibliography, 12926
radionuclides,
accumulation in Columbia River biota, 12922
cycling in Columbia River biota, 13731
sedimentation of salmonid spawning beds, effects of logging, 13316
sediments, suspended and deposited, re estuarine organisms, bibliography, 12925
sodium halides and gamma radiation effects on rainbow trout, 13194
sublethal poisoning in fish, method for detecting and estimation of, 14076
sulfite liquor and D. O. effect on juvenile salmon, Bellingham Bay, Wash., 13909
sumithion, effects of spraying on salmonids, 13373, 13822
surface active agents, effects on marine animals, 14214
temperature, increased-, effects on coldwater organisms, 13792
thermal,
analysis, 13168
beneficial uses of heated water in cooling reservoirs, 13424
effect on Connecticut River ecosystem, 13425
loading in N. Y. Marine District, 13734
requirements to protect aquatic life, 12877, 12878
resistance of rainbow trout to temperature variation, 13401
toxaphene,
analysis in waters, fish, sediments, by gas chromatography, 13400
role of lake sediments, water chemistry of, 14167
toxic substances demonstrated using Lebistes reticulatus, 13190
toxicity, utilizing and applying bioassay results, 13012
waste discharges, simple method to assess effects on benthos, 13904
water,
biological effects, 12898
-quality of,
California streams re logging, 14156
Lake Superior, 13246
yellow phosphorus production wastes, toxicities to fish in sea water, 14028
zinc, effect on oxygen and phosphate metabolism of bluegill liver mitochondria, 13791

Populations,
albacore, abundance on No. Pacific longline grounds, 12838
alewife, species interactions in Great Lakes, 12798

Populations, cont.
bass, striped,
preliminary results of tagging in Virginia, 1968-69, 13993
strength of 1966 year-class in three Va. rivers, 13991
billfishes of,
Atlantic Ocean, 13387
Central Pacific, re harvest, 12914
biostatistical method of A. N. Derzhavin, 13362
Black Sea food fishes, recruitment, 1965-68, 13464
bream, European, biology in upper Ob' River, USSR, 13521
carp, Lake Carl Blackwell, Okla., 12852
cestode-, of Swedish whitefish, effect of lake regulation on, 14178
changes, Lake Francis Case, 1952-68, 13331
char, Arctic,
meristic differences, Sagavanirktok River drainage, Alaska, 13129
morphology and variability, Kamchatka River, USSR, 13462
crustaceans, sampling in four Idaho lakes, 13014
demersal fishes off La. and Texas, abundance, distribution and species, 14198
density, re salmonid movements in two Idaho streams, 14135
eel-, Rhode Island- and Icelandic-, variation in, 14215
eelgrass, stocks and features in Alaska, 13100
estimates of, and river electrofishing, 13975
fecundity, regularities in change in, on example of sprats, 13391
fish,
caution re manipulation with respect to food production, 13572
communities in Brier Creek, Okla., during summer, 13713
differences above and below impoundment, 13117
exploited-, calculation of sustainable yield, 13388
fauna of,
Leaf River, Ungava, 13828
new lake near Veere, Netherlands, especially plaice, 14005
in Rostherne Mere, England, 14074
lower Dnieper River re flow regulation, 13520
Smoky Hill River, Kansas, during irrigation development, 13054
within inland waters of Horn Island, Miss., 12884
Woods Hole, Mass., area, numbers and lengths by seasons, 13198
flounder,
summer, tagging study in N. J. waters, 14163
yellowtail, abundance in Newfoundland area, 13345
grayling, in Alaska, length-weight relationship and condition factors, 13569
herring larvae, seasonal variation in condition, Boothbay, Maine area, 13108
hybrid, natural-, of spiny sturgeon X kura sevryuga, 13670
lamprey, sea, control in Great Lakes, 12799
limiting factors re fish abundance, 13142
menhaden, Atlantic,
abundance of larvae at two N. C. inlets, 13548
resource and fishery analysis of decline, 13924
minnow, fathead, exponential decrease, 12803
mixed-, exploited-, bluegills dominate, 14011
nonsalmonids with furunculosis, 13339
northern pike-, bluegill-, study, 13177
parameters, evaluation based on catch and effort data, 13384
perch,
European, qualitative differences in young, 13025
Pacific Ocean-, 13290
seasonal abundance re reproduction, 13622
pike, northern, management, 12814
Poeciliopsis monacha-occidentalis, all-female form in northwestern Mexico, 13855
pumpkinseed in Cranberry Pond, Mass., 13568

Populations, cont.
recruitment,
curves, comparison, 13912
dependence on parent stock in different groups of fishes, 14109
roach, European, decline in Chew Valley Lake, England, 13488
rockfishes, especially Pacific Ocean perch, in northeastern Pacific, 12097
sailfish, Atlantic, developmental caanges in young, 13494
salmon,
Atlantic, third report of ICES/ICNAF joint working party, 14049
chum, acclimatized in Caspian Sea, life history, 13682
coho, oceanic, stock identity and movement study with ^{65}Zn, 13057
sex ratios and survival estimates, 13599
sockeye,
biology of Skeena River, 12905
juvenile, assessing stock by echo integration, 13188
spawning, surveys in Bristol Bay, Alaska, 13637
salmonids,
abundance in Columbia River basin, 13196
and other fishes in forest streams of southern England, 13789
in small mountain lake, Sweden, 13560
shad, threadfin, central Arizona reservoirs, 12797
shiner, sand-, esterase function and genetics of populations, 13641
shrimp, ocean-, vertical migration off Oregon, 13078
smelt, spawning in Amur River, biology re population dynamics, 13522
species diversity and abundance, methods, 13379
stilling basin-, below Canton Reservoir, Okla., 13314
sturgeon,
production and stocks throughout world, 13911
Siberian, blood serum albumen in two populations, 12982
survey and charting of fisheries resources, 14022
trout,
brook,
effect of increased mortality of young, theoretical analysis, 14136
hatchery- and natural-, lens protein polymorphisms in, 14147
in Colo. beaver ponds, 13450
response to a fishery, 13628
lake, biology in Lake Superior before 1950, 13121
tunas,
and marlins in Atlantic Ocean, 13389
larval, Gulf of Calif., 12896
warm-water fish in southern Mich. lake, characteristics of, 14160
zooplankton,
effects of predation by alewife, Lake Mich., 13430
production with prolonged reproduction, 12826

Predation,
alewife on zooplankton,
Canandaigua Lake, N. Y., 13574
effects, Lake Michigan, 13430
in ten Adirondacks lakes, effect, 13555
Alloperla nymphs on salmon eggs, fry, 12788
bass,
largemouth, re decrease in fathead minnow population, 12803
yellow, adults on young, 12794
bear, brown, on sockeye salmon at Karluk Lake, Alaska, 13796
food of predatory demersal fish in Hauraki Gulf, New Zealand, 13995
prey-fish size, reconstruction from vertebral fragments, 13540
salmonids, stream-, salmonid eggs as food for, 14043
sculpins,
on fall chinook fry from hatcheries, 13197
stream-, salmonid eggs as food for, 14043

Production,
bacteria in freshwater reservoirs, USSR, 12915
bass, striped,
party boat fishery, 1960-68, Calif., 13323
report on fry culture, Georgia hatchery, 14181
billfishes in Atlantic Ocean, 13387
bluegills dominate in exploited mixed population, 14011
carp yield re source and concentration of dietary protein, Israel, 14010
char, Arctic, in a small Arctic lake, 13491
egg-, of flathead catfish, 12987
fecundity and gonads in brood carp and bream, Volga Delta, 13019
fish,
in ponds, relationship of P and N thru plankton, 13921
in strip-mine pond in western Maryland, 13710
samples and year-class strength, 1965-67, Canton Reservoir, Okla., 13318
food,
for fish populations, caution re manipulation, 13572
resources and utilization by fishes, Tsimlyansk Reservoir, USSR, 13530
invertebrates in freshwater reservoir, USSR, 12913
limiting factors re fish abundance, 13142
La. lake and river, 14189
macrozooplankton and small nekton, off Vancouver Island and Wash., 1963, 13333
nutrient limiting factors in oligotrophic pond, 13131
phytoplankton,
chemical factors in, experimental lakes, Canada, 13589
in freshwater reservoirs, USSR, 12915
pike, northern, comparison of yield from planting of adults and fry, 13970
plankton discharges from upper reservoir re crop in lower one, Mo. river, 13041
primary-,
experimental lakes area, Canada, 13588
in Chesapeake Bay, 12872
physical and biological, near entrance to Gulf of Calif., 12897
study procedure re benthic algae, 12909
surface chlorophyll as index of euphotic-layer productivity, -depth, -chlorophyll, 13042
production-cycle/spawning date/egg sizes, interrelations, 13478
recruitment curves, comparison, 13912
reservoirs, USSR, invertebrates stocked as food source, 13838
salmon, sockeye, Fraser River rearing system under-utilized, 13612
salmonids,
and other fishes in four streams of southern England, 13789
in small mountain lake, Sweden, 13560
juvenile, carrying capacity of some northern Calif. streams, 13326
smelt, spawning in Amur River, biological characteristics re population dynamics, 13522
sturgeon, throughout world, 13911
sunfishes, effect of water hyacinths and fertilization on, 14180
Thames River, England, contribution of young fish to total, 13483
trophic condition of Lake Superior, 13246
tyul'ka, Azov, food of larvae, feeding conditions re abundance, 13676
zooplankton,
abundance in Canton Reservoir, Okla., 13264
seasonal calorific values via modified calorimeter, 13874
with prolonged reproduction, 12826

Radiobiology,
acoustical data for fishery research, electronic processing of, 13624
autoradiography, in study of hypothalamo-neurohypophysial complex of eel, 12900

Radiobiology, cont.
^{14}C,
activity in photosynthesis, liquid scintillation method for determining, 13588
cortisol injected into salmon, radioactivity changes re sexual maturation, 13394
-DDT,
transformation and accumulation in flatfish, 12917
uptake, distribution and elimination in trout, 12790
-dieldrin, uptake, distribution and elimination in trout, 12790
-histamine metabolism in yellow eel, 13775
incorporation in sturgeon eggs, young, 13020
-labelled benthic microflora, liquid scintillation method for assaying, 13940
$^{14}CO_2$ fixation by cod spermatozoa, 13113
^{90}Cs, concentration by freshwater fishes, 14134
^{137}Cs,
Colorado trout lake studies, 13189
concentration by fishes of freshwater lakes, 14132
elimination in the mullet and blenny, 14041
echo integration for assessment of juvenile sockeye stock, 13188
^{55}Fe concentrations in commercial fishes of North Atlantic, 13033
gamma radiation and sodium halides, effects on rainbow trout, 13194
^{131}I, seasonal variation in accumulation and loss by catfish tissues, 13544
laser rays, for detection and analysis of elements in tissue slices, 13608
radioactive caesium, accumulation and excretion by plaice and ray, 13814
radioecology, estuarine, bibliography, 12926
radionuclides, in Columbia River biota, 12922, 13731
radiophosphorus, uptake from water by tilapia, 13165
radiotelemetry re winter gillnetting, ice jigger location, 13307
radiothyroxine, biliary excretion by brook trout, 13429
sonar fish counter, 13155
^{90}Sr, concentration by freshwater fishes, 14134
ultrasonic,
properties of freshwater fish tissue, 12863
tracking re behavior of skipjack tuna, 12950
UV,
for disease control in eggs, fishes, 13146
irradiation to eradicate Ceratomyxa shasta from water, 13301
sterilizer for water of fish egg incubators, 13468
X-ray,
acute-, effect on plaice eggs, larvae, 13487
and temperature re mortality of salmon embryos, 13545
spectrometry for discrimination of salmonids, 13489, 13620
^{65}Zn,
concentration by eggs of Black Sea turbot, 14127
for movement study and stock identity of oceanic coho, 13057

Reproduction,
artificial propagation of Atherina boyeri, 13660
bass,
black-, sea-, artificial spawning thru CG hormones, 13772
striped, report on fry production and rearing, Georgia hatchery, 14181
yellow, changes re environmental conditions, 13862
biology of silverjaw minnow in Kentucky, 14146
bream, eastern, morpho-biological characteristics, 13668
breeding,
behavior of Fla. flagfish, effects of ABS on, 14045
fishes, use of formulae for efficiency of food conversion, 1321
induced-, of grey mullet, 13918, 13919
of Indian carps by pituitary injection, 13001
carp,
age and size composition of spawners in Kuibyshev Reservoir, USSR, 13536

Reproduction, cont.
carp, cont.
injection of dried pituitary to control spawning re muskellunge culture, 13507
selective and intensified breeding of carp in ponds, USSR, 13094
silver, initial results of breeding in ponds, Israel, 13658
catfish, sea-, in Arabian Sea, 13526
courtship of six sunfishes, sound production during, 13694
-curves, effect of superimposed mortalities on, 13059
cycle, re pituitary gland of goby, 13133
egg,
production of flathead catfish, 12987
size,
key factors affecting, in rainbow trout, 14000
re size and age of female salmonids, 13525
fecundity,
and state of gonads in brood carp and bream, Volga Delta, 13019
of,
Atlantic salmon from two Maine rivers, 13938
coho salmon from Lake Michigan, 13079
hatchery rainbow trout after exposure to DC electricity, 14150
regularities of change in, on example of sprats, 13391
fertilization,
and development of herring eggs in fresh water, 13032
of salmon eggs with cryo-preserved sperm, 13935
of trout eggs, effect of copper, nickel, 13807
flounder, White Sea-, 13674
herring, Baltic, spring- and autumn-, lipids in eggs, young and spawning females, 14125
isolation,
between two sympatric daces, Manitoba, 13334
in two species of stickleback, 12934
lamprey, Volga, below Volgograd Dam, and larval development, 13672
maturation,
and gametogenesis in male whitefish reared in USSR waters, 13018
of skipjack in western Pacific, 13986
nesting success of bluegill, Ohio farm pond, 12860
oogenesis and fecundity in Japanese horsemackerel, 14122
perch, Pacific Ocean, re distribution and abundance, 13622
percids, and spawning grounds and larvae in Kuibyshev Reservoir, 14124
pikeperch, females,
effect of pituitary injections on maturation, 14121
physiology and biochemistry, Don River, USSR, 13467
polyspermy possibilities in bony fishes, 13015
precocious male quinnat salmon in New Zealand, 13017
prespawning behavior of sunfishes, environmental factors, 13261
salmon,
chinook,
effect at Hanford nuclear complex, 12978
fall-, fecundity, upper Columbia River, 13639
chum-, acclimatized in Caspian Sea, 13682
sockeye,
Fraser River rearing system under-utilized, 13612
Skeena River, alternation of age of return, a hypothesis, 13867
sculpin, shorthorn, in Newfoundland waters, 12946
sex ratio and fecundity,
and maturation of masu salmon at sea, 14197
of American smelt, 12822
sexing adult largemouth bass externally, 13302
shad, threadfin, excelsior mats used successfully for spawning and transportation of eggs, 13966

Reproduction, cont.
smelt, spawning in Amur River, biological characteristics re population dynamics, 13522
spawning,
anadromous fish, Cape Fear River, N. C., 12933
areas of salmonids in Columbia River, 13196
artificial-, of walleye, muskellunge, pike, with quinaldine and MS-222, 12991
Atlantic mackerel in waters of southeastern Newfoundland, 12951
Atlantic salmon, changes in corpuscle of Stannius, 13403
beds,
quality re growth of salmon embryos, fry, 12815
salmonids, effects of logging on sedimentation, 13316
behavior of chestnut lamprey, 13107
billfishes in Atlantic Ocean, 13387
biology of Lake Ladoga pikeperch, 13524
carp, laboratory technique for, 13300
changes in activity of,
energy-metabolizing enzymes, kokanee salmon, 13651
muscle glycolytic enzymes, kokanee salmon, 13650
channel, Rocky Reach, for chinook salmon, evaluation, 13638
coho, effect on benthos in Platte River, Mich., 13122
conditions, Black Sea food fishes, 1965-68, 13464
date/egg sizes/production cycle, interrelations, 13478
extended-, environmental influences, rainbow trout, 13553
fall,
-chinook in Columbia River near Hanford, 1947-69, 13613
of channel catfish, 13968
grounds, artificial-, for sturgeon, 13132
habits and fecundity of Arctic grayling, 13294
hormone-induced-, Gulf croaker, 13162
induced-,
in carp with fish pituitary extract, 14102
of northern anchovy, 13806
of striped mullet, 12808
of cunner in northern N. J. waters, 12881
paddlefish, serum characteristics, 13687
periods of Caspian grey mullets, 13359
populations, sockeye, surveys, Bristol Bay, Alaska, 13637
repeat-, and scale growth of Amur whitefish, 14129
season, mullets along Israeli coast, 13824
spring- and autumn-, of Atlantic herring, meristic differences, 13872
stickleback, brook, temperature re prespawning movements, 14038
striped bass, shift in sites in Chesapeake Bay, 13701
testes weights in tilapia before and after, 13247
time, effects of variation on growth and viability of young carp, 13825
trout, brook, effects of long-term exposure to copper, 13931
yellowtail flounder, Newfoundland area, 13345
spermatozoa of grey mullet, environmental factors influencing activity, 13482
walleye of Lake Winnebago region, 12938

Research,
ABS and LAS, comparative effects on mosquitofish, 13502
air-economizer apparatus for use in fish work, 13474
anesthesia, dynamics of MS-222 in fish blood and brain during, 13034
anesthetic studies, DP-1166---potent fish anesthetic, 13756
antimycin, effects of physical and chemical conditions on detoxification, 13170
assay of minimum amounts of kraft effluents affecting fish respiration, 13013
avoidance reactions of fish, 13376
BCF station,
Beaufort, N. C., 1968-69, 12932, 13010
Gulf Breeze, Fla., 1969, pesticides in estuaries, 13009

Research, cont.
BCF station, cont.
Miami, Fla., 1965-69, 13038
Pascagoula, Miss., 1967-69, 12928
St. Petersburg, Fla., 1969, 12836
bioassays,
chronic-, constant-flow device for, 13245
to determine allowable waste concentrations in waters, 13575
carp, grass, criteria for studying feeding, re weed control, 13962
cell lines, salmonid and mammalian, CO_2 requirements, 13289
century of fisheries in North America, 14018
chemical languages of fishes, bullhead experiments, possible use in fish control, 13519
chemicals against fish, method for rating potency, 12969
chloralhydrate effects as anesthetic on tilapia, 13255
chlorbutol effects as anesthetic on tilapia, 13255
Cooperative Fishery Unit report for 1969-70, 13505
DDT, food chain model for kinetics in freshwater marsh, 13263
delayed initial feeding, effects on grunion larvae, 13811
directory of fish culture research institutions, 13927
disease cases, 5-year summary of S.E. Coop. Fish Dis. Lab., 14170
environments, experimental-, light-control apparatus, 13215
eutrophication in large lakes and impoundments, 13602
experimental lakes studies, Canada,
characterization by sediment diatoms, 13595
chemical characterization of water, 13587
chemical factors in phytoplankton production, 13589
chemistry of surface sediments, 13596
crustacean plankton, 13591
geography and bathymetry of selected basins, 13584
hypothesis on similarities and differences among lakes, 13585
initial survey, 13583
light, temperature and oxygen regimes, 13586
periphyton, 13590
primary production and phytoplankton, ^{14}C activity in photosynthesis, 13588
rationale, background and development, 13582
vertical distribution and seasonal abundance of zooplankton, 13592
zoobenthos, 13594
exploratory fishing for non-ciguatoxic sport and food fish, Virgin Islands, 13895
explosives for frightening fish, 13684
FAO Fish Culture Bulletin, 13744, 13745
fish-guiding system, electrical-, water velocity re efficiency, 13498
fisheries potential of Virgin Islands, 13894
fishery,
associations in United States, 1969-70, list, 13656
electronic processing of acoustical data, 13624
workers, inland-, of Europe, list, 14064
fishes in pest situations, 12876
frescon, for control of snail host of Diplostomum, field trial, 14105
gastric, burbot as test subject for Basov's fistula, 13685
herbicides, effects on water and inhabitants, 13368
herbivorous fish,
for weed control, 14056
in fish farming and weeding of reservoirs, 14055
immunization against furunculosis, antigenecity testing of vaccine, 13298
insecticide-resistant fish, possible selective mechanisms in development of, 13366
insecticides, interactions affecting residue storage in rainbow trout, 13378
kinetic model of toxicity threshold of fish, 13907
laboratory, floating-, for study of aquatic organisms and their environment, 14169
lamprey, sea, control in Great Lakes, 12799

Research, cont.
marine,
in the coastal plains region of southeastern U. S., 13890
-resources, report on 6th session of UN Advisory Committee, 13961
melanophore responses,
reflectance method for measurement, 13370
in teleosts, continuous recording of, 13375
mercury,
analysis, syringe procedure for transfer of nanogram quantities of mercury vapor, 13857
determination in fish by atomic absorption, 13605
in the environment, 13518
wastes, satisfactory disposal of, from water laboratories, 14065
MS-222, effects as anesthetic on tilapia, 13255
mullet, grey, coordinated studies on, 14173
multivariate analysis for fishery biology, 13473
pentachlorophenol determination in organic tissues and water, 13399
poisoning, sublethal-, in fish, method for detection and estimation of, 14076
pollutant toxicity measurement: chronic effects and "safe" concentrations, 14015
polychlorinated biphenyls solubilized by surfactants for toxicity studies, 13390
propoxate, effects as anesthetic on tilapia, 13255
propylene phenoxetol, effects as anesthetic on tilapia, 13255
quinaldine,
as anesthetic for Pacific intertidal fishes, 12801
effects as anesthetic on tilapia, 13255
influence of pH on efficacy in residues in bass, 14149
reclamation of,
lakes by chemical method---polychlorpinene, 12963
waters with piscicides, FAO review, 13130
review of 1969-70 FRB of Canada, 13882
rotenone,
changes of toxicity to trout with time, 13860
surfacing of dead fish after application, 12802
salmon,
Atlantic, Salmon Research Trust of Ireland, Inc., 13458
IPSFC Annual Report - 1970, 14144
serology, serum antibodies, goldfish, effects of cold storage, 13308
sodium cyanide, observations on use in stream surveys, 13903
spermiation of goldfish as bioassay for salmon gonadotropin, 13396
sport-fishery-, prospectus for Great Lakes, 12973
sport fishing seminar, 1970, Myrtle Beach, S. C., 14075
"Sport Fishing USA", published by USDI, Bur. Sport Fish. & Wildl., 13769
structures, artificial-, for attracting coastal pelagic fishes, 13181
toxaphene, analysis in waters, fish, sediments by gas chromatography, 13400
toxicity of,
effluents to fish, standard tests, 12858
H_2S to juvenile fish and fish eggs, 13499
33 NCS to freshwater fish and sea lamprey, 12971
29 nitrosalicylanilides to 8 species of fish, 12970
pesticides to fathead minnow in presence of LAS, 13372
pollutants, utilizing and applying bioassay results, 13012
substances in water to fish, and herbicide threshold toxicities, 14052
urethane, effects as anesthetic on tilapia, 13255

River,
Altahama, fat cycles and condition factors of shads, 14013
Amur, biological characteristics re population dynamics of spawning smelt, 13522
Androscoggin, N. H., recreational use of 13-Mile Woods section, 13886
benthos, differences above and below impoundment, 13116
Brier Creek, Okla., fish communities during summer, 13713

River, cont.
canals, ship-, and aquatic ecosystems, 14063
Cape Fear, N. C.,
basin, Notropis mekistocholas --- a new herbivorous cyprinid of, 14073
passage of fish thru locks; spawning and nursery, 12933
Chatanika, Alaska, hybrids between inconnu and humpback whitefish, 13571
chemical elements in tissue slices, detection and analysis with laser rays, 13608
Chignik, system, identification of sockeye groups, 13633
Coeur d'Alene-, productivity re toxicity of zinc to rainbow trout, 13665
Colorado, lower-, analysis of baitfish industry, 13084
Columbia,
central-, feeding of juvenile chinook salmon, 13733
Cestrahelmins rivularis from white sturgeon, 13737
chinook salmon mortality near Bonneville Dam, summer of 1955, 13985
contribution of hatchery salmon to harvest, 1966, 13056
cycling of radionuclides in biota, 13731
dissolved N, effect on salmonids, 13925
distribution of marked hatchery chinook in marine fisheries, 13058
effects of,
dam on dissolved nitrogen and salmon, 12786
thermal increase on eggs, young of chinook, 13644
experimental drifts of juvenile salmonids thru Hanford effluents, 13666
fall chinook spawning near Hanford, 1947-69, 13613
Indian net fisheries, efficiency and economics, 12931
influence of fish ladders on columnaris disease, 13869
spawning areas and abundance of salmonids, 13196
upper-, fecundity of fall chinook, 13639
Danube,
estuaries, planktonic crustaceans parasitic to fish, 12916
fishes and their distribution, 14114
Delaware, status of striped bass in, 14067
Dnieper, fish fauna of lower reaches re flow regulation, 13520
Don, USSR, physiology and biochemistry of pikeperch females, 13467
Elbe, Germany, differences in clupeid larvae, 13433
English rivers, water quality and absence of fish, 13397
fish populations, differences above and below impoundment, 13117
Forest, N. D., helminth parasites of fishes from, 14099
Fraser, sockeye rearing system under-utilized, 13612
Gaspereau-, evaluation of fishway for alewives, 13667
Green, Etheostoma barbouri, new darter from, 13248
Kamchatka, USSR, morphology and variability of Arctic char, 13462
Kävlingeån, Sweden, ecology of ide, 13556
Kings, Calif., occurrence of chinook salmon, 13321
Leaf, Ungava, fish fauna, 13828
Lugg, England, food of grayling, 13481
Mena, dispersal and remaining of stocked juvenile masu salmon, 13830
Miramichi, Canada,
commercial and sport utilization of Atlantic salmon, 13619
growth rate of Atlantic salmon between Greenland and home waters, 13445
Mississippi, Upper-, sport fishery survey, 1967-68, 13844
Missouri, effect of plankton discharges from upper reservoir on crop in lower one, 13041
Ob', biology of bream in upper reaches, 13521
Platte, Mich., effect of coho spawning on benthos, 13122
polluted-, large-, oxygenation possibilities for, 14176
Potomac, Upper,
cluster analysis of non-insect macroinvertebrates, 13852
diatoms and algae re power-plant discharge, 13288
Qualicum, transfer of pink salmon spawn to, 3-generation results, 13930
Rio Grande, water quality and environmental factors, effect on fish, 13603
Rocky Reach spawning channel, for chinook salmon, evaluation, 13638

River, cont.
Roseau, Manitoba, temperature re movements of pre-spawning sticklebacks, 14038
Sabine, La., survey of factors affecting fish production, 14189
Sacramento-San Joaquin system, distribution of sturgeon larvae, 13074
Sagavanirktok-, drainage, Alaska, Arctic char differences, 13129
Sannosukezawa-kawa, dispersal and remaining of stocked juvenile masu salmon, 13830
Saskatchewan-, DDT, DDE and DDD residues in fish re blackfly control, 13125
Skeena,
alternation of age of return of sockeye salmon, a hypothesis, 13867
system, gillnet selectivity on sockeye and pink salmon, 14032
Smoky Hill, Kansas,
fish populations during irrigation development, 13054
life history of sand shiner, 13068
Snake, dissolved N, affect on salmonids, 13925
St. Joe, Idaho, distribution and growth of fluvial and adfluvial cutthroat trout, 14058
St. Lawrence, DDD residues in ecosystem after application, 12812
St. Maries, Idaho, food habits and ecology of mayflies, 13813
streams, Calif., water quality of, re logging, 14156
Sulak, USSR, antigenic features of Caspian salmon and brown trout, 13686
Tennessee, cave and spring fishes of southern bend, 13910
Terek, USSR,
antigenic features of Caspian salmon and brown trout, 13686
overwintering period of sturgeons, 13837
Thames, England, contribution of young fish to total production, 13483
Vistula, 11-year growth study of seatrout, 12893
water, persistence of pesticides in, 14206
Willamette, lower-, water quality re migration of fall salmon, 12977

Sampling,
bass, striped,
evaluation of gonadal biopsy from tag returns, 13256
strength of 1966 year-class in 3 Virginia rivers, 13991
benthos,
and substrate down to 15 micron size in shallow streams, 14033
comparison of effectiveness of Ekman and Ponar grabs, 14152
profundal, multiple corer for, 13104
quantitative artificial substrate sampler, 13251
shallow-water, simple corer vs. Ekman grab, 13616
capture of lake trout alevins, Lake Heney, Quebec, 13377
catch of Pacific Ocean perch, techniques and intensity required, 13282
cave and spring fishes of southern bend of Tenn. River, 13910
computer program for capture-recapture model of Jolly, 13623
creel,
census data, actual vs. reported fishing time as factor, 13311
survey,
Okla., re different types of fishing, 12862
reservoirs, recommended method of reporting, 13457
crustaceans in 4 Idaho lakes, 13014
exploratory fishing for non-ciguatoxic sport and food fish, Virgin Islands, 13895
fish,
and crustacean populations in sewage-enriched estuarine ponds, 13954
population estimates and river electrofishing, 13975
samples and year-class strengths, 1965-67, Canton Reservoir, Okla., 13318
fishes, Woods Hole, Mass., area, numbers and lengths by season, 13198
fisheries potential of Virgin Islands, 13894
Flatbrook, N. J., trout studies, 14159
flounder, summer, tagging study in N. J. waters, 14163

Sampling, cont.
gear for larval reservoir fishes, 13978
gillnetting, winter-, radiotelemetry for ice jigger location, 13307
kicking technique for stream bottom fauna, evaluation, 13642
larvae, fish-, kinds and abundance in eastern tropical Pacific, 13159
macroinvertebrates,
benthic; basket-type artificial substrate for sampling, 14151
non-insect-, of upper Potomac River, cluster analysis, 13852
marine fishes of Virginia's eastern shore, 13238
mark-recovery method for estimating anglers' catch, 14143
perch and walleye fry, meter net for, 13702
plankton, quantitative sampler, 14175
post-larval fish and macroplankton, improved methods, nets, 12856
salmonids, juvenile, constant-fraction device for enumerating, 13979
sampler,
egg- and fry-, hydraulic, 13640
free-vehicle-, bottom-water-, 13436
sled-mounted-, suction-, 13008
stomach capacity, method of estimating, 14155
stream surveys, observations on use of sodium cyanide, 13903
substrate-, sieve and trough for washing samples on boat, 13514
survey,
and charting of fisheries resources, 14022
creel, 1969, of Illinois portion of Lake Michigan, 13065
of heavy metal contamination of Canadian freshwater fish, 13943
technique for enumerating kokanee fry migrating thru streams, 13876
virus from waters, flow-thru gauze sampler, 13801

Specific,
aholehole, 13501
albacore, 12838, 12937, 13383, 13388, 13389, 13808, 14070
alewife, 12798, 12833, 13047, 13430, 13555, 13574, 13667, 13736
amur, white, 13960
anchovy, 13954
bay, 13432
Black Sea, 13464
northern, 12855, 12964, 13447, 13806
striped, 13257
Apogon, 13727
Arius thalassinus, 13526
Atherina boyeri, 13660
Auxis, 12896
rochei, 13808
ayu, 14174
ballyhoo, 13187
barbel, 14114
bass, 14112
black, sea, 13772
largemouth, 13173, 13302, 13726, 14047, 14057, 14095, 14149, 14207
rock, 12924
smallmouth, 12924, 14057, 14139, 14207
striped, 12871, 12873, 12882, 13256, 13286, 13297, 13323, 13465, 13688, 13701, 13902, 13991, 13993, 14067, 14158, 14166, 14181

Specific,
bass, cont.
white, 12924, 14148, 14153
yellow, 12794, 13862
Bathygobius, 13727
beaugregory, 13557
Benibuna, 13270
bighead, 14055
bitterling, 13029
bleak, 13947, 14108
blenny, 14041
bloater, 12948, 13892
bluefish, 12792
bluegill, 12860, 12947, 12970, 13064, 13070, 13169, 13171, 13173, 13177, 13296, 13322, 13398, 13472, 13499, 13570, 13654, 13694, 13791, 13889, 14011, 14017, 14113, 14180, 14220
bonito, 12937, 13758, 13759, 14070
Pacific, 13808
bowfin, 12971, 13780
bream,
blue, 13137, 13684
eastern, 13668
European, 13019, 13026, 13521, 13683, 14001, 14114, 14128
red, sea, 13268
sea, 13233, 13265
white, 13149
buffalo,
bigmouth, 12845, 13066
smallmouth, 12845, 12930, 14164
bullhead,
black, 12924, 12970, 13703, 14090
brown, 13313, 13414, 13519, 14115
yellow, 13519

Specific, cont.
burbot, 13098, 13685, 13828
cabezon, 12801
capelin, 13341
Caranx kalla, 14211
cardinal fish, 14216
carp, 12804, 12845, 12852, 12970, 12971, 13019, 13045, 13094, 13141, 13204, 13214, 13216, 13219, 13220, 13223, 13225, 13228, 13233, 13235, 13258, 13266, 13268, 13272, 13276, 13279, 13300, 13363, 13357, 13435, 13452, 13455, 13507, 13529, 13535, 13536, 13538, 13539, 13546, 13606, 13677, 13678, 13690, 13739, 13753, 13757, 13762, 13818, 13823, 13825, 13843, 13845, 13846, 13847, 13905, 13906, 13946, 13949, 14010, 14102, 14114, 14115, 14117, 14133, 14174
bream, 12908, 13455
grass, 12975, 13435, 13922, 13962, 14055, 14199
Israeli, 14009
mirror, 13662
silver, 12975, 13147, 13435, 13658, 13677, 13763, 13923, 14055
carpsucker, river, 12845, 12930, 13546
catfish, 13119, 13136, 13141
blue, 13319, 13964
channel, 12804, 12965, 12971, 12976, 12989, 13004, 13040, 13072, 13544, 13579, 13840, 13843, 13881, 13888, 13964, 13968, 13988, 14094, 14189,
European, 13746, 14114
flathead, 12845, 12987
sea, 13479, 14198
white, 12804, 13414
cavefish,
blind, 13854
southern, 13910
spring, 13910
char, 13559, 13560, 13695, 13696
Arctic, 13022, 13129, 13462, 13491, 13785, 13828, 13882, 13989
chub,
bigeye, 12965
creek, 13547, 13910
European, 13051
hornyhead, 13117
river, 13117
chubsucker, lake, 12965
Cichlasoma cyanoguttatum, 13788
Cirrhina mrigala, 13001

Specific, cont.
cisco, 12948, 13392, 14039
Clarias lazera, 13239
coalfish, 14219
cobia, 13250
cod, 12974, 13045, 13085, 13089, 13113, 13348, 13393, 13800, 14219
Atlantic, 12861
Baltic, 13531, 13720
Pacific, 14036
Coregonus,
albula, 13561
clupeoides, 14104
peled, 13729, 13765
Coryphaenoides acrolepis, 13431
Cottus gobio, 13486, 13789
crappie,
black, 13173, 14154
white, 13040, 13291, 13551
croaker, 13795, 13841
Atlantic, 12885, 13730, 13954, 14019, 14198
Gulf, 13162
cunner, 12881, 14028
dace,
blacknose, 13102, 13334, 13910
longnose, 13334
darter,
bluntnose, 12958
goldstripe, 12958
naked, sand, 12958
orangethroat, 12995
speckled, 12958
Tuscumbia, 13910
dogfish, spiny, 12953
Dojo fish, 13071
dolphin, 13808
pompano, 13808
Dory, American, John, 13995
drum,
freshwater, 12845, 12924, 13200, 14164
red, 13257, 13549
eel, 13046, 13209, 13211, 13233, 13269, 13273, 13276, 13277, 13434, 13442, 13741, 13760, 13776, 13787, 14174
American, 12953, 13237, 13329, 13607, 14062, 14215, 14224
European, 12900, 13069, 13182, 13184, 13329, 13607, 13842, 13851, 14089
yellow, 13775
Enophrys bubalis, 13486
Etheostoma,
barbouri, 13248
obeyense, 13248
virgatum, 13248
Euthynnus affinis, 13808
flagfish, Fla., 14045
flatfish, 13954, 13998

Specific, cont.
flounder, 12921, 13720
Arctic, 12974
ocellated, 13709
southern, 14093
starry, 13705
summer, 12966, 14163
White Sea, 13674
winter, 12953, 13353, 13643, 14192
yellowtail, 13345, 13438
fluke, European, 12974
Gadus callarias, 13275
Gambusia sp., 13657
gar, 13780
longnose, 13888
Gasterosteus aculeatus, 13789
goby,
bighead, 13746
Caspian, round, 13746
Hyrcanian, 13746
toad, 13133
goldfish, 12818, 12864, 12957, 12970, 13052, 13071, 13218, 13270, 13308, 13342, 13356, 13396, 13418, 13543, 13645, 13738, 13756, 13760, 13818, 13819, 14071, 14085, 14174, 14192
gourami, blue, 13118
grayling,
Arctic, 13294, 13569, 13936
black, Baikal, 13143, 13456, 14131
European, 13481, 13948
greenling, painted, 13601
grouper, giant, 13242
grunion, 13049, 13327, 13811
guppy, 13402, 13442, 13501, 14205
gurnard, red, 13995
haddock, 14097, 14110
hake, Pacific, 13336
halfbeak, 13187
halibut, 12921
herring, 12887, 13087, 13108, 13191, 14114
Atlantic, 13872, 13882, 13974, 14028, 14059, 14109
thread, 13257
Baltic, 14125
Hokkaido, 14109
lake, 12999, 13516
Norwegian, 14109
Pacific, 14109
Volga, 13746
White Sea, 12848, 12870, 13032
horsemackerel, 13464, 13995
Black Sea, 13681
Japanese, 14122
hucho, 13948

Specific, cont.
ice-goby, 13210
ide, 13069, 13556
inconnu, 13571
jack, crevalle, 13557, 13700
jacksmelt, 13408
jenny, silver, 13257
khalisa, 12879
killifish, 14157
bluefin, 12965
Gulf, 14081, 14092
longnose, 12884
plains, 12955, 13448
kingfish, southern, 14222
Konosirus punctatus, 13271
Labeo rohita, 13001
ladyfish, 13257
lamprey, 12820, 13210
American, brook, 13254, 13877, 14203
chestnut, 13107, 13254
mountain, brook, 12819
northern, brook, 13254
river, 13053
sea, 12799, 12971, 13096, 14203
silver, 13254
southern, brook, 13706
Volga, 13672
Lateolabrax japonicus, 13224
Lebistes reticulatus, 13190, 13661
Leuciscus cephalus, 13412
lizardfish, inshore, 14198
loach, 12906, 12943, 12979
lungfish, Australian, 14192
mackerel,
Atlantic, 12874, 12951
frigate, 13808
jack, 13230, 13804, 13805, 13809, 13897, 13899
Japanese, 14179, 14182, 14183
king, 13981
Spanish, 13981, 14217
marlin, 13387
menhaden,
Atlantic, 12919, 12932, 13010, 13548, 13707, 13924, 13983
yellowfin, 13050
minnow,
bluntnose, 13117
fathead, 12803, 12970, 13110, 13253, 13356, 13372, 13499, 13725
sheepshead, 12884, 13385
silverjaw, 12816, 14098, 14146
Misgurnus fossilis, 12834
mojarra, striped, 13257
mollie, sailfin, 13106
mosquitofish, 12884, 13371, 13501, 13502, 13603, 13790, 13803
Mugil,
auratus, 13717, 13824
capito, 13717, 13824
chelo, 13824
cephalus, 13824
saliens, 13824

Specific, cont.
mullet, 13464, 13949, 14041
Black Sea, 13679
Caspian, gray, 13359
gray, 13482, 13918, 13919, 14173
striped, 12808, 12936, 13187, 13271, 13610, 13779, 14162
mummichog, 12843, 12874, 12927, 13167, 13236, 13338, 13407, 13777, 13954, 14028, 14078, 14079, 14080, 14115, 14193, 14194, 14195
muskellunge, 12991, 13507, 13515
nase, 14114
navaga,. 12974
nehu, 13501
Nemacheilus barbatula, 13789
Nocomis, 13992
Notropis,
chrysocephalus, 13910
gibbsi, 13249
mekistocholas, 14073
trichroistius, 13249
omul, Baikal, 13024
Oplegnathus, 13276
Opsariichthys unicirostris, 14196
orfe, golden, 13030
Oryzias latipes, 13232
Osmerus eperlanus, 13532, 13561
dentex, 13522
paddlefish, 12845, 13415, 13687, 13786, 13888
Pagrus major, 13271
peled, 13035
perch,
European, 12908, 13025, 13138, 13156, 13392, 14074, 14124, 14126
Pacific Ocean, 12941, 13097, 13282, 13290, 13622, 14213
Sacramento, 12791
silver, 13257, 13841
white, 13167
yellow, 12824, 12924, 12970, 13426, 13702, 13725, 13735, 14101
Phoxinus phoxinus, 13789
pigfish, 13841
pike, northern, 12814, 12827, 12944, 12991, 12992, 13002, 13048, 13141, 13177, 13405, 13411, 13423, 13499, 13684, 13857, 13970, 14002, 14074, 14114
pikeperch, European, 12908, 13392, 13455, 13467, 13524, 13528, 13746, 13915, 13999, 14114, 14121, 14124, 14126
Pimelometopon pulchrum, 13431
pinfish, 13257, 13557, 13798, 13841, 13954, 14004, 14200

Specific, cont.
piranha, 13854
plaice, 13487, 13716, 13720, 13814, 13956, 13957, 14005, 14040
Platichthys flesus, 12917
platy, variated, 13600
Plectoplites ambiguus, 13634
Poecilia, 12899, 13950, 13959
latipinna, 12884
Poeciliopsis, 13564, 13855, 13959
pompano, 13410, 13504, 14142
pope, 14124
porgy, longspine, 14198
powan, 13948
puffer, 13756
pumpkinseed, 13051, 13261, 13568, 13654
Puntius gonionotus, 14199
pupfish, 13593
desert, 13161
Owens, 14145
quillback, 13174
raven, sea, 13865
ray,
eagle, 13995
thornback, 13814
redfin, eastern, 13671
roach,
Azov, 13528
European, 12908, 13185, 13455, 13488, 13675, 13684, 14074
rockfish, 12961
channel, 13900
ruff, 13043, 13392
runner, blue, 13557
sailfish, 12935, 13295, 13387, 13494
salmon, 12786, 12788, 12865, 12867, 12981, 13007, 13091, 13114, 13160, 13280, 13453, 13503, 13663, 13664, 13783, 13853, 13909, 14043, 14135, 14190
Atlantic, 12807, 12810, 12830, 12861, 12868, 12903, 12940, 12952, 12972, 13088, 13111, 13135, 13151, 13154, 13373, 13403, 13445, 13458, 13485, 13525, 13563, 13604, 13619, 13697, 13789, 13817, 13822, 13838, 13866, 13870, 13875, 13882, 13938, 14021, 14049, 14068, 14224
Baltic, 12893, 13021
Black Sea, 13913
Caspian, 13140, 13686
cherry, 14184
chinook, 12787, 12840, 12850, 12977, 12978, 13056, 13058, 13062, 13077, 13153, 13193, 13197, 13295, 13321, 13367, 13382, 13404, 13416, 13495, 13496, 13498, 13545, 13554, 13599, 13613, 13638, 13639, 13644, 13733, 13925, 13935, 13985, 14072, 14137, 14138

Specific, cont.
salmon, cont.
chum, 12785, 12847, 12890, 12891, 12892, 13206, 13340, 13466, 13611, 13646, 13647, 13648, 13682, 13833, 13834, 13835, 13836, 13853
coho, 12785, 12796, 12850, 12977, 13023, 13057, 13060, 13061, 13079, 13112, 13122, 13193, 13196, 13281, 13285, 13326, 13352, 13495, 13496, 13498, 13554, 13599, 13618, 13638, 13693, 13722, 13799, 13869, 13879, 13884, 13935, 13988, 14138
hime, 14184
kokanee, 13325, 13495, 13496, 13649, 13650, 13651, 13876,
landlocked, 12833
masu, 12888, 13017, 13830, 13831, 13832, 13987, 14197
Pacific, 12880, 12988, 12990, 13086, 13554, 13868, 14007, 14013, 14072, 14109
pink, 12815, 12891, 13017, 13340, 13466, 13882, 13891, 13930, 13979, 14032, 14091
quinnat, 13016
silver, 13316
sockeye, 12785, 12823, 12844, 12869, 12889, 12905, 12945, 13023, 13099, 13126, 13188, 13196, 13340, 13346, 13347, 13382, 13394, 13495, 13496, 13612, 13620, 13621, 13631, 13632, 13633, 13635, 13636, 13637, 13755, 13768, 13796, 13816, 13853, 13863, 13864, 13867, 13891, 13926, 13979, 14012, 14032, 14034, 14138, 14204
sanddab, speckled, 12801
sardine,
Calif., 14109
Japanese, 14109
Pacific, 13598, 13898
scaled, 13181, 13257, 13432
Spanish, 13181
saury, 13848
scad, 13181
scorpionfish, 12954
sculpin, 12939
banded, 13910
coastrange, 13197
longhorn, 12953
prickly, 13197
reticulate, 13197
shorthorn, 12946, 12953, 13335
slimy, 13828, 13892, 14043
torrent, 13197
yellowfin, 13024

Specific, cont.
Scyliorhinus canicula, 14087, 14088
seaperch, pink, 13939
seatrout, 13360, 14198
European, 12893
silver, 14198
Sebastes,
aleutianus, 13343
caenaematicus, 13343
melanostomus, 13343
variegatus, 13810
Sebasticus marmoratus, 13226
Seriola quinqueradiata, 13224, 13227, 13274, 13275, 13752
Serranus hepatus, 14185
shad, 13244
American, 13306, 14013
gizzard, 13766
hickory, 14013
threadfin, 12797, 13180, 13843, 13966
yellowfin, 13257
shark, 13267, 13770
dogfish, 14192
nurse, 14046
shemaya, 13523, 13673
shiner,
bigmouth, 13829
golden, 12841, 13349, 13356
longnose, 12965
rough, 12965
sand, 13068, 13641
spotfin, 13117
white, 13751
shinerperch, 13990
silverside, 13954
Atlantic, 13238, 13714
tidewater, 12884
skate,
little, 12953
thorny, 12861, 12883, 12903, 12904
skipjack, 13986
black, 12896
smelt, 13892, 14028, 14108
American, 12822, 12833, 12924, 13101
snapper, 13995, 14120
gray, 13413
vermilion, 13573
snook, 13262, 13749
sole, 12857, 12918
flathead, 12835
lined, 13257, 13982
petrale, 13284, 13934
spot, 13409, 13798, 13841, 13954, 14019
sprat, 13391
stickleback, 12934, 13110, 13350, 13655
brook, 14038
fourspine, 13201
ninespine, 13828, 13892

Specific, cont.
stickleback, cont.
threespine, 13631, 13820, 13828, 13902
twospine, 13202
Stizostedion, 13287
stoneroller, 13910
sturgeon, 12825, 12984, 12985, 13020, 13122, 13139, 13415, 13427, 13743, 13837, 13911, 14114
Atlantic, 13856, 13859
Caspian, 13139
green, 13074, 14084
lake, 13552
Russian, 13669
Siberian, 12982
spiny X sevryuga, kura, 13670
Volga, 14123
white, 13074, 13737, 13896, 14084
sucker, 12846
Alabama, hog, 12930
blue, 13090
Gila, 13843
largescale, 13869
longnose, 13828
Sonoran, 13843
spotted, 12930
white, 12924, 12944, 13417, 13499, 13566, 13973, 14100
sunfish, 12971, 13199, 14112
green, 12970, 13064, 13603, 13694, 13843, 13880, 13910, 13971
longear, 12800, 13261, 13694
orangespotted, 13694
redear, 13694, 14180
spotted, 13694
surfperch, 13901
surmullet, 13464
swordfish, 12866, 13115, 13387
swordtail, 12899, 13069
tench, 13031, 13094, 13141
tetra,
blue, 13854
head and tail light, 13854
Mexican, 13854
sailfin, 13854
Thunnus obesus, 13808
Tilapia, 12804, 12920, 13045, 13247, 13501, 13843, 14199, 14210
aurea, 13774, 13821, 14187
esculenta, 14107
galilaea, 13821, 14187
guneensis, 13476
hornorum, 13337
mariae, 13476
melanopleura, 13337
Specific, cont.
Tilapia, cont.
melanotheron melanotheron, 13476
mossambica, 13148, 13255, 13337, 13475, 13712, 13821, 14187
nilotica, 14187
volcani, 13821
zillii, 13165, 13337, 13821, 14107, 14187
timucu, 13187
toadfish, Gulf, 13479
Trachurus japonicus, 13271
trevally, 13995
trout, 12971, 13028, 13091, 13178, 13310, 13449, 13453, 13477, 13560, 13663, 13664, 13695, 13696, 13723, 13790, 13850, 13860, 13887, 14043, 14114, 14135
brook, 12821, 12833, 12948, 13075, 13076, 13109, 13111, 13373, 13429, 13450, 13451, 13627, 13628, 13732, 13782, 13799, 13827, 13828, 13858, 13928, 13929, 13931, 13948, 14028, 14066, 14077, 14136, 14147, 14159, 14184
brown, 12952, 13111, 13164, 13463, 13484, 13493, 13686, 13699, 13789, 13827, 13948, 13953, 14077, 14103, 14106, 14155, 14159
cutthroat, 12789, 12949, 13006, 13127, 13175, 13176, 13179, 13189, 13316, 13326, 13511, 13550, 13665, 13799, 13980, 14012, 14058, 14212
Dolly Varden, 12929, 13023, 14201
lake, 12799, 13095, 13105, 13121, 13377, 13625, 13742, 13767, 13828, 13861, 13892, 14031
rainbow, 12790, 12805, 12813, 12829, 12831, 12886, 12942, 12952, 12959, 12960, 12970, 12972, 12986, 12992, 13035, 13037, 13075, 13076, 13103, 13158, 13189, 13194, 13233, 13240, 13241, 13243, 13276, 13298, 13301, 13315, 13316, 13326, 13351, 13378, 13382, 13386, 13395, 13401, 13406, 13408, 13428, 13438, 13442, 13446, 13495, 13498, 13499, 13508, 13525, 13533, 13538, 13553, 13565, 13708, 13724, 13740, 13748, 13771, 13773, 13778, 13784, 13794, 13799, 13807, 13849, 13851, 13878, 13882, 13932, 13942, 13953, 13965, 13967, 13988, 13994, 14000, 14003, 14012, 14072, 14077, 14150, 14159, 14168, 14184, 14192, 14201, 14209, 14212, 14218
steelhead, 12786, 13114, 13193, 13196, 13281, 13320, 13382, 13498, 13554, 13925, 14137, 14138
trout-perch, 13892

Specific, cont.
tuna, 13037, 13252, 13770
bigeye, 13389
blackfin, 14051
bluefin, 12793, 12937, 13389, 14070
Pacific, bigeye, 13388
skipjack, 12832, 12937, 12950, 13152, 13389, 13808, 13984, 14025, 14026
southern, bluefin, 13389
yellowfin, 12937, 12896, 13389, 13808, 13984, 14025
turbot, Black Sea, 14127
tyul'ka, Azov, 13676
vendace, 14108
vimba, 13523, 13673

Specific, cont.
wahoo, 13808
walleye, 12938, 12991, 13073, 13292, 13499, 13506, 13702, 14141
warmouth, 13173
weakfish, 12874, 12885, 14221
whiff, bay, 13709
whitefish, 13439, 14130, 14178
Amur, 14129
broad, 13018
humpback, 13571
lake, 12863, 13111, 13828
mountain, 13126, 14155
round, 13828
zebrafish, 13051
Zenarchopterus, 13027

Stocking,
acclimatization of fishes in Bratskoe Reservoir, USSR, results, 13355
carp, Israeli, in Lake Dojran, Yugoslavia, 14009
catfish, blue, introduction into Calif., 13319
Coregonus peled, acclimatized in northeastern Poland, 13729
exotic fishes and other aquatic organisms introduced into N. America, 12968
invertebrates as food for increasing fish production, reservoirs of USSR, 13838
mysids, in Mingechaur Reservoir, USSR, as fish food, 13915
perch, Sacramento, current status in N. America, 12791
pike, northern, comparison of fingerling yield from stocked adults and fry, 13970
prophylactic measures in stocking new fishes in waters, 13381
salmon,
chinook, juvenile, influence of release location, 12787
chum, acclimatized in Caspian Sea, life history, 13682
coho, 1964-hatchery-, effect of release size on harvest, 13060
masu, dispersal and remaining of juveniles in Japanese rivers, 13830, 13831
pink, 3-generation results of planting spawn in Qualicum River, 13930
trout,
brown, advantages of fall and spring planting in Chelker Reservoir, England, 14106
cutthroat, in Munsel Lake, Oregon, evaluation, 13179
Flatbrook, N. J., studies, 14159
rainbow,
four strains in Beardsley Reservoir, Calif., comparison, 13315
harvest, movement and growth in Great Lakes, 13565

Survival,
alewives, landlocked, stocked in Maine lakes, 13736
ammocoetes at low oxygen tensions, 12820
anchovy, northern, larvae, effect of food density, 13447
aquatic insects, effect of low pH, 14014
aroclor 1254 in Escambia Bay, Fla., 12894
Atheriniformes, freshwater, effect of hypophysectomy, 12899
bass,
smallmouth, effects of fin-clipping, 14139
striped,
evaluation of gonadal biopsy from tag returns, 13256
fingerlings, toxicity of 9 therapeutants and pesticides, 13297
re pollution in Delaware River, 14067
bleak, heavy mortalities in Italian lakes due to Branchiomyces fungi, 13947
bluegill, effect of paraquat, Colo. farm pond, 13296
burbot, long-lived-, with a Basov gastric fistula, 13685
carp in dilute copper sulfate solutions, 13818

Survival, cont.
cisco larvae, temperature requirements for, 14039
Clarias lazera, without air breathing, 13239
Coregonus peled, acclimatized in northeastern Poland, 13729
effects,
of surface active agents on marine animals, 14214
of temperature and environmental factors on fish, Rio Grande River, 13603
on fish and invertebrates of oil from foundered tanker near Wake Island, 14048
fish,
-guiding system, electrical-, water velocity re efficiency, 13498
kill due to oil from coke ovens, 13802
toxic effects of trace organics, 13205
vs. chemicals, method for rating potency, 12969
young, effect of polymicrofertilizers, 12911
goldfish in dilute copper sulfate solutions, 13818
haddock, tagged- and untagged-, after capture by trawl or seine, 14110
herbicides, effects on water and inhabitants, 13368
Heterophyes sp. in mullet flesh, effect of oxy- and chlortetracycline, 13610
jack, crevalle, mass mortality along Massachusetts coast, 13700
kraft effluents, assay of minimum affecting fish respiration, 13013
larvae of Black Sea fishes, re food supply, 13134
Lebistes reticulatus, used for demonstrating toxic substances, 13190
minnow, sheepshead, sensitivity of 3 generations to pesticides, 13385
mollie, effects of dieldrin on SGOT, 13106
mortality,
hooking-, of Yellowstone cutthroat trout, 13006
in young rainbow trout, possibly from DDT, 13994
of trout, char marked with nylon thread tags, Sweden, 13695
rates, typical-, eastern Lake Erie, 12924
sequential-, of marine fishes impounded at Dana Point, Calif., 13901
superimposed-, effect on reproduction curves, 13059
turbine-, studies, device for fish recovery, 13007
NTA as anti-pollutant protecting fish from copper, zinc, 12875
perch, Sacramento, adaptability and introductions in N. America, 12791
percid larvae, re food and temperature, 14126
pike, northern,
comparison of fingerling yield from stocked adults and fry, 13970
embryos under different oxygen conditions, 13048
plaice eggs and larvae, effect of acute X-rays, 13487
pompano, juvenile, toxicity of therapeutics, 13504
salmon,
Atlantic,
delayed mortality after spraying forests with DDT, 13817
effects of spraying forests with DDT, sumithion, phosphamidon, 13822
bioassay of eggs, sac fry in copper solutions, 13077
chinook,
effects of thermal increase on eggs, young, Columbia River, 13644
juvenile, effect of release location, 12787
mortality in Columbia River, near Bonneville Dam, 1955, 13985
coho, pre-smolt-, effect of salinity, 13618
effect of dam, Columbia River, 12786
embryos, mortality and growth re temperature and X-rays, 13545
juvenile, thermal tolerance re nitrogen supersaturation, 13193
pink, 3-generation results of planting spawn in Qualicum River, 13930
salmonids, juvenile,
effects of aerial spraying of sumithion, 13373
experimental drifts thru Hanford effluents, 13666
placement of gatewell orifices in dams, 13554
screens for diverting from turbine intakes, 14137

Survival, cont.
sex ratios re survival estimates by Murphy's methods, salmon, 13599
sharks, captured, lactate acidosis as cause of mortality, 13267
stream organisms, effect of industrial spills, 13692
sublethal poisoning in fish, method for detecting and estimation of, 14076
sucker, white, eggs, at different dissolved oxygen levels, 13973
thermal requirements to protect aquatic life, 12877, 12878
tolerance, heat-, of albino vs. normal channel catfish, 12976
toxicity of,
ABS to mosquitofish, 13502
ammonia to striped bass and stickleback, re temperature and salinity, 13902
aroclor 1254 to pinfish, spot, 13798
carbaryl to four salmonids, 13799
DDT to five semi-tropical fishes, 13501
DDT to four salmonids, 13799
de-inking wastes with detergents to salmon, 13891
dieldrin to five semi-tropical fishes, 13501
effluents to fish, standard test, 12858
endrin to four salmonids, 13799
heptachlor to aquatic life, 12879
H_2S to juvenile fish and fish eggs, 13499
kraft effluent to Atlantic salmon, 12868
LAS to bluegill, influencing factors, 13169
LAS to mosquitofish, 13502
lindane to five semi-tropical fishes, 13501
malathion to four salmonids, 13799
methoxychlor to fathead minnow and yellow perch, 13725
33 NCS to freshwater fish and sea lamprey, 12971
29 nitrosalicylanilides to eight species of fish, 12970
2 organic nuclear-reactor coolants to fish, 12886
pesticides to fathead minnow in presence of LAS, 13372
phenol to five semi-tropical fishes, 13501
PMA and metoxyethylmercuric chloride to Oryzias latipes, 13232
poisons to five semi-tropical fishes, 13501
pollutants,
measurement of; chronic effects and safe concentrations, 14015
utilizing and applying bioassay results, 13012
pulp mill sulfides to salmon, Washington, 12880
rotenone to trout with time, 13860
selected herbicides to,
bluegill, 13070
crustaceans, 14053
sodium pentachlorophenate to carp, re temperature, 13905
substances in water,
and herbicide threshold toxicities, 14052
threshold for fish, kinetic model of, 13907
yellow phosphorus production wastes to fish in sea water, 14028
trout,
brook, effects of long-term exposure to copper, 13931
cutthroat,
hooking mortality re temperature, fatigue, maturity, 12789
toxicity of zinc re productivity of Coeur d'Alene River, 13665
lake, in Lake Superior before 1950, 13121
rainbow,
effects of gamma radiation and sodium halides, 13194
hatchery-reared-, after exposure to DC electricity, 14150
resistance to temperature variation re thermal pollution, 13401
walleye eggs at various oxygen levels, 13506
winterkill-, variability in yellow perch, 13426

Vegetation,
algae, benthic, procedure for primary production study, 12909
aquatic, plastic barrier for spot treatment, 13304
Chara, controlled with paraquat, effect on bluegill, 13296
decay of aquatic weeds: O utilization and N and P regeneration, 14223
eelgrass, stocks and features of Alaskan populations, 13100
Elodea preferred by stickleback over Potamogeton for habitat, 13201
kelp, drifting, fishes associated with, southern Calif., 13317
plants, aquatic-, vascular-, ecology in southern Ontario impoundments, 13797
seaweeds and seagrasses near Port Aransas, Texas, guide, 13083
vascular plants, aquatic, role in eutrophication, western Mass. lakes, 13580
water hyacinths and fertilization, effect on food organisms and sunfish production, 14180
weed control by,
grass carp, criteria for studying feeding, 13962
herbivorous fish, 14056
in reservoirs, 14055

Virology,
device for removing fish embryo from egg, re viral multiplication study, 13123
Egtved virus: antibodies in serum from infected rainbow trout, 14035
IPN virus, 14006
Swiss albino mouse as host, 13477
lymphosarcoma, cell-free transmission in pike, 12827
sampler, flow-thru-, gauze-, for recovering virus from waters, 13801
virus,
Newcastle-disease-, replication in salmonid cell lines, 12839
Sacramento River - chinook-, 13367
replication in salmonid cell lines, 12839
sockeye-salmon-,
properties, 12844
replication in salmonid cell lines, 12839
species specificity and cytopathology in salmonid cells, 13382
western-equine- encephalitis-, replication in salmonid cell lines, 12839

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